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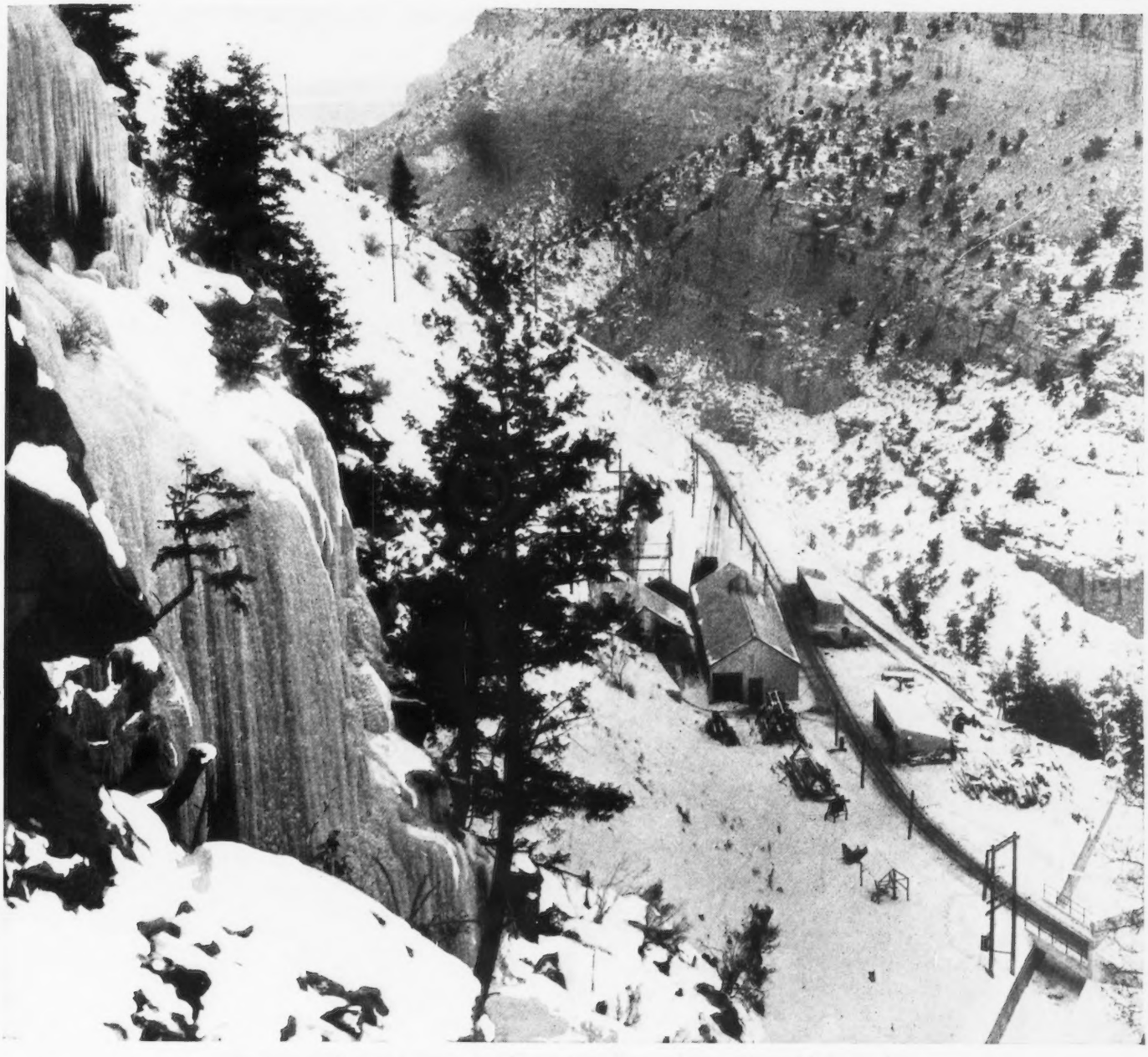

## PECOS MINE: A NEW ZINC-LEAD PROJECT

BY A. H. HUBBELL

## THE OIL SHALE INDUSTRY

BY GUY C. RIDDELL

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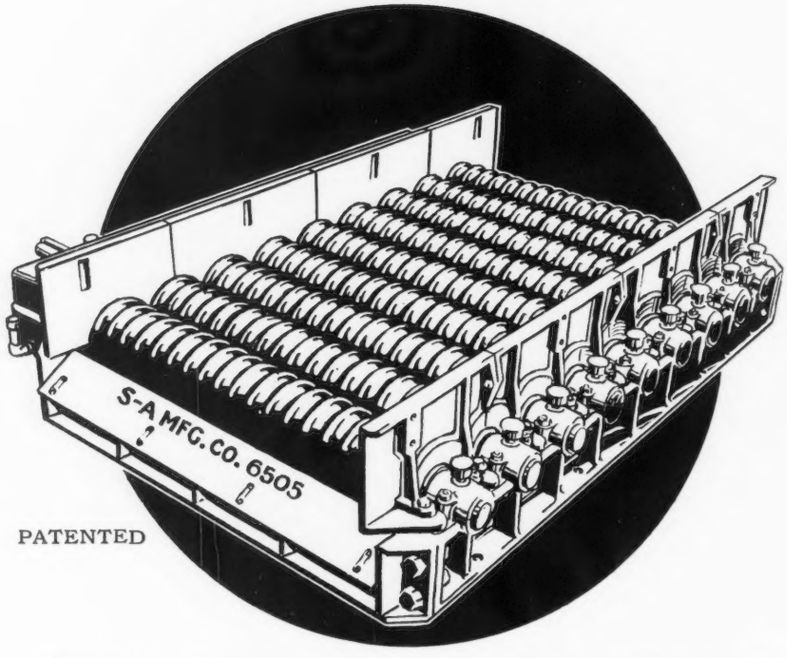


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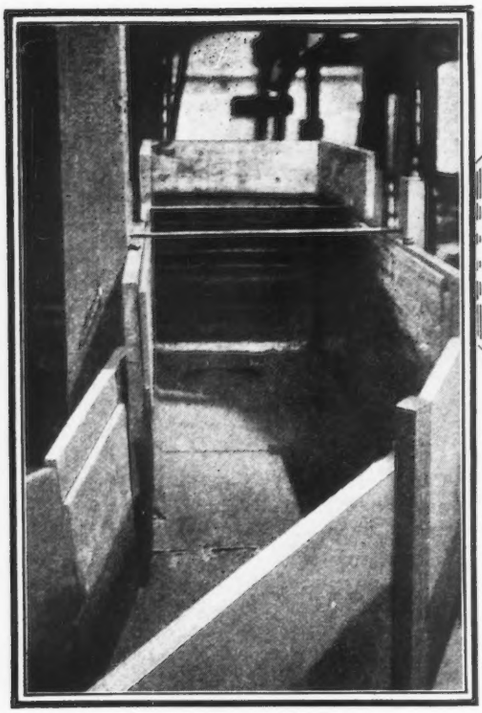

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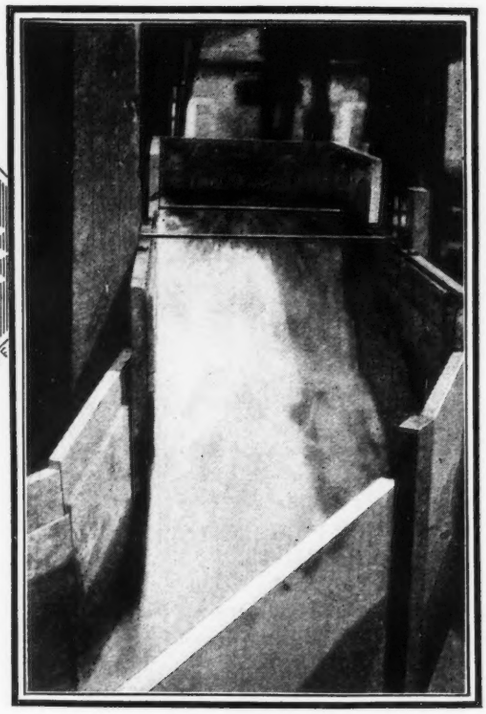

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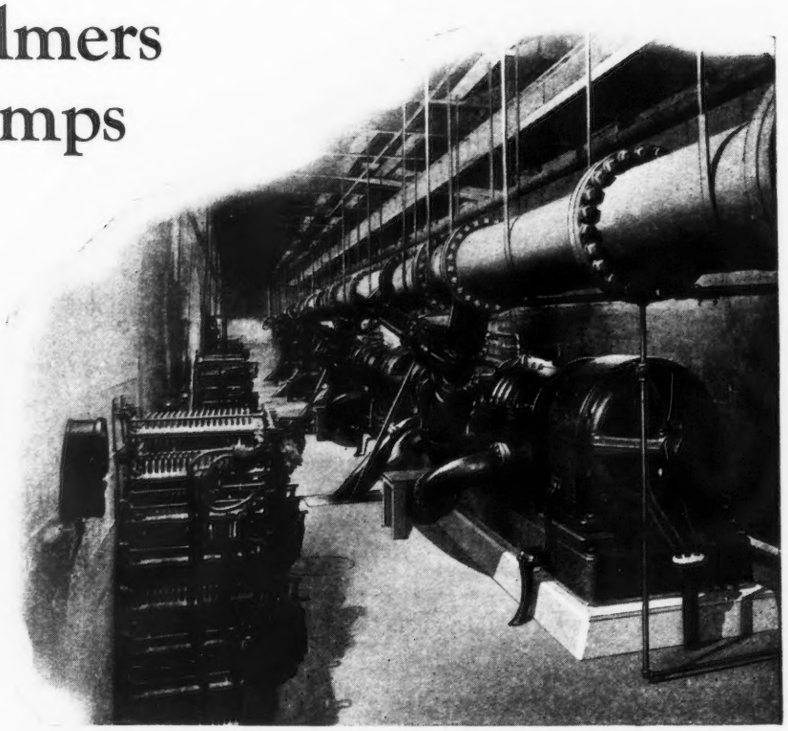

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ENGINEERING AND
MINING JOURNAL

JOSIAH EDWARD SPURR, Editor

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## The Reign of Law

WHETHER THE REIGN of law will not develop into a reign of terror and of anarchy is a subject now suitable for debating societies. Also whether the couple "law and order" is not an anachronism.

The tremendous past and present output of our legislative mills has been often pointed out of late; and the flood still continues. The interpretation, where this is possible, of this mass of material is the function of the lawyer, who accordingly multiplies and becomes more powerful and essential. The laws are so many that every citizen breaks many every day, despite all efforts to avoid misdemeanors. When serious matters are put to test in the light of the law, it is found that in the maze there are many existing laws which favor, or exculpate, or excuse, or ameliorate the act of the possible offender; while there are many other points of the law which emphasize and clinch the gravity of his action and prescribe serious punishment. Under the circumstances, the best advice a friendly attorney can and does give his client is to keep out of the law and the interpretations of the law—to keep out of the court and away from the battlefield of lawyers.

In spite of all which, and of the Arbitration Society of America (that most admirable organization), the courts are necessarily crowded by cases, including cases by the government, prosecuting offenders against the law—murder cases, prohibition cases, fraud cases, and all the rest—and also including civil cases between contentious parties, or suits brought because the machinery of the law permits chicanery, and under cover of the law a man may secure an advantage which a fair referee would not allow. The courts are crowded with cases because the mazes of the law, artfully used and multiplied by the lawyers, prevent progress of prompt and fair justice; and thus many an offender eludes for a time or for all time the courts, simply because they haven't time for him. A succession of appeals from one court to another, together with other legal stays and obstructions, may consume years.

In the procedure of obstructing and blinding justice, the stage is set for the lawyer to play the major rôle, while maintaining his respectability as practicing a "legitimate" profession. Recent spectacular trials have emphasized the fact that the ethics of the lawyer in summing up the case—let us say, for the government, against an official charged with fraud—permit and enjoin him to twist the facts and their arrangement so as to prove the rotten character and despicable traitorism of the accused, and, moreover, to artfully use in addition appeals to unreasoning emotion, to induce a fagged and bewildered jury to send the accused to jail and stigmatize them forever. On the other hand, legal ethics permit and enjoin the attorney for the defense to twist the facts so as to prove that his clients (who pay him) are innocent, or even patriots equal to Lincoln, or heroes like the legendary Dutch boy who stuck his hand in the leak of a dike; and—again playing upon the emotions—he denounces the attorneys and witnesses for the government with fearsome epithets, for this persecution of his client, lugging in the pathos of the gray-haired wife or mother, the appeal to the American flag, and the picture of the little red school house.

Both of these opposing attorneys have heard the same evidence, and by their training in interpretation they have probably arrived at the same conclusion as to the truth, or would have were they not paid to close their minds. The government itself is as prominent a party to this stupendous, expensive and disintegrating farce as the private individuals or interests.

Such practice corresponds to legal ethics, but does it fulfill the conceptions of honor, decency, and justice? The answer is not in doubt. Lawyers of this type stand high in their profession and their course is not questioned; but are they to be admitted to the ancient and unchartered company of gentlemen? The question, again, is purely rhetorical: the answer is evident. We are confronted, indeed, with a condition where peace and justice and morals are threatened by the cancerous growth of the very machinery which was originally designed to protect and insure these blessings. When the pacific progress of civilization, when individual right and justice, are determined, not by truth, equity, and kindliness, but by the relative "smartness" of lawyers whose obfuscating abilities are for sale to criminals and honest citizens alike, one may well be startled from any state of comfortable and conservative complacency.

## U. S. Steel's Dividend

OF CHIEF INTEREST in New York financial circles last week, and, for that matter, perhaps to the business interests of the country generally, was the announcement of the intention of the directors of the United States Steel Corporation to recommend a stock dividend of 40 per cent. Stock dividends have come to be known as melons, and the casual reader of headlines would, in this instance, get the impression that holders of the common stock of the Steel Corporation will have securities worth 40 per cent more after the dividend has been declared than they had before. However, there is no reason to believe the common stockholder will be any better off except that he will, in all probability, get a dividend of $7 plus 40 per cent, or $9.80 per present share per year, instead of $7 as heretofore. In other words the yield on his investment at current market prices will be about 6 per cent, instead of 4½ per cent, as theretofore. There is no reason to believe that his holdings will be worth much if any more, as the price of the stock will drop

automatically, for example from $160 to about $114, when the stock goes ex dividend. In other words, though the stockholder has more shares of stock, his equity remains the same. The low yield on the stock recently has indicated that some distribution of stock or increase in the dividend was discounted.

For many years the Steel Corporation has pursued a policy of turning a large proportion of the profits of the enterprise back into the business. Twenty or so years ago the shares were largely "water"; now there is something like $280 of solid assets behind each share. Net earnings that might have been applied to common dividends last year amounted to $65,000,000, whereas the amount actually paid out to common shareholders was only $35,000,000; this year's net on the same basis has been estimated at $89,000,000, compared with the same amount, $35,000,000, actually paid out. The policy of the directors has been to build up the company for posterity rather than to give current shareholders their full portion of current earnings.

The action of the Steel directors has been interpreted as an assurance from one of the dominant financial groups of the country that business will continue good during 1927. No one has really thought otherwise, but the reassurance will be welcome. Even though business may be considerably less active than in 1926, the action of the Steel Corporation, in view of its own financial position, would still seem well advised.

## "Normal" Price for Copper

THEORY often appears to be exploded; but theory correctly predicated on economic law always will prevail. The trouble is that reasoning is not always sound. One hears the statement made repeatedly that "the price of copper is abnormally low." The argument generally advanced is that, whereas lead, zinc, oil, wool and steel and a dozen other basic commodities bring from 15 to 100 per cent more than they did in 1913, copper is actually selling for less. Therefore the price of copper is below "normal"! Or, it will be contended that as $1.50 is required on the average to buy commodities that cost $1 in 1913, the "normal" price of copper today should be half again as high as it was in 1913. Neither course of reasoning is sound.

It is true, of course, that the existence of some overcapacity in equipment for production has created a buyer's rather than a seller's market, and this has a tendency to depress the price slightly. But this influence is not of sufficient moment persistently to keep the price down in material degree. In a free, broad, and competitive market like that of copper the price will always be in the general neighborhood of "normal"; this is true in theory, and strong evidence exists to show that it is true in fact. The normal price for any commodity, by definition, is the approximate cost of production at a given time of that part of the whole supply that is produced at the greatest disadvantage. This is known as the marginal production.

A moment's reflection shows clearly why the normal price of copper in 1926 is measurably less than the normal price of 1913. Improved methods of mining, concentrating, and smelting, and increased outputs from individual properties, with consequent economy: these have reduced the cost of production in spite of higher wage scales and generally increased commodity prices. Necessity for efficiency may have been more dire than in the instance of other metals; but whatever the reason the achievement is remarkable. Moreover, the development of many large new mines with low production costs has enabled the industry to meet soaring consumptive demand with low-cost metal. As a consequence the cost of the marginal production, instead of being increased, has been lowered. Right here, incidentally, lies the reason for the advance in lead price; the cost of the marginal production has increased.

So much for theory—for economic law. What are the practical evidences that the price is not far from normal? Profits and dividends. Recent months have seen dividend payments resumed by some, increased by others. A large part of the copper-mining industry apparently is prosperous.

At the same time a tendency is apparent toward increased output on the part of many producers, particularly the "low-cost" group in North and South America. If future increases are important, and if world consumption lags behind, it is conceivable that the "normal" price will be lowered still more. It may follow that the present marginal producers will find themselves pushed over into the class that cannot even make ends meet.

Some of the low-cost group have operated at curtailed capacity for several years, seemingly for the purpose of nursing the market. Have they concluded that they can do better by increasing production even at the expense of a possible depression of the average price? A profit of 4½c. per pound on 20,000,000 lb. is much better than a profit of 5c. per pound on 17,000,000, especially when the depletion of ore reserves is not an important factor. A complication of course arises from the fact that some companies are interested in both high- and low-cost producers.

If the process of shutting down and restarting a mine were not so exceedingly expensive it is probable that operations at some of the higher-cost properties would be suspended if the policy were to be adopted generally of pushing output at the low-cost properties to the maximum. It is to be assumed in making this statement that consumption does not expand proportionately with increased production. It is possible that it may be found advisable to shut down in spite of the immense cost. Whatever may happen, they will be deceiving themselves who argue that the price of copper is far below "normal." They had better not rely on a return to normality. The best they can hope for is a readjustment in supply and demand that will establish a new normal at a higher level.

## The Seven-Day Week

RECENT DISCUSSION over the five-day week has doubtless brought to various mining men the recollection of the numerous occasions when custom or chance has called upon them to work seven days a week. Once this was the regular practice in most of the Western camps. Today it is much less prevalent. Of necessity smelters continue to operate their furnaces without consideration for the calendar, with but few exceptions. But in the mines it is not now uncommon to shut down on Sunday, save for the pump and shaft work. The reasons may vary with the camp.

Cripple Creek furnishes an interesting example: For-

merly there it was the custom of the principal operators to shut down on Sunday in the summer time, when labor diminished in supply, owing to the call of farming and other lures, and to run seven days weekly throughout the rest of the year when this condition bettered. At length it came to be noticed that, according to the records, the output of six days' work a week in summer compared favorably with that of seven in the remaining months. Acting upon the hint thus offered, the operators have adopted Sunday closing throughout the year.

It is well established in other lines of industry that six-day operation gives more general satisfaction than seven days' work a week. For one thing, though not the most important from the operating viewpoint, the practice fits in with the varied needs of man and favors the development of normal life in the community. Those mines now running steadily throughout the month and year might give this matter the consideration that it merits.

## What's in a Name? A Lot

MR. HUMPHREY McNUTT writes us concerning the psychological expression and impression of names. Graminivorous creatures are timid and gentle, and so stand for admirable and lovable symbols, such as lamb—e.g., "my little lamb!" or symbols of contempt, as "sheep"—e.g., "they went like sheep." The distinctions between the two attitudes towards gentleness are sometimes fine, as the Frenchman found who desired to write his sweetheart that she was "a plump little dove," and by the aid of the dictionary substituted the synonymous term "a fat squab."

On the other hand, carnivora are confessedly dangerous and treacherous and liable to eat one. Therefore Mr. McNutt believes that the assumption of the name of George Graham Rice by a wolf of Wall Street, born under the not-so-pleasing name of Jake Herzig, marks a stroke of sound diplomacy. In suggesting that the first name also be left out, he remarks that the breakfast food suggestion is among the mildest and most suggestive of financial health. He further suggests that the literary gems in Mr. Rice's publication be headed "Graham Gems," and says it would be gratifying to discover whether or not he has a secretary named Farina. Once started on this philosophical strain, Mr. McNutt seemed inclined to pursue it indefinitely, but we dumped the balance of his letter into the wastebasket.

## Government and Industry

AT THE RECENT MEETING of the Mining Congress in Washington, the coal situation was discussed by a number of speakers, from various angles. These speakers included two members of the President's Cabinet. Among a variety of views expressed there was one undercurrent of agreement—that interference by the government in the coal industry should be avoided. In this the representatives of the industry and of the administration both in effect agreed. This is not, to be sure, the attitude of the legislative branch of the government, whose business is passing bills, so that a Representative or a Senator, especially if he comes from a mining district or a great center of mineral consumption, counts that day lost when he does not introduce a bill providing greater government control or patronage of mining. The legislative branch creates laws; the executive branch has to put them into effect; and in this is seen the reason for the care-free industry of the Senator and Congressman, and the careful warning of the administrative officers against forcing the government to take a hand. But the Congressman or Senator will not introduce or vote for a bill for government supervision or control unless he feels a real or fancied pressure from his constituents. He has his ear to the ground; he wants to be popular, and then pass the buck.

An example of passing the buck in a more august sphere was the passage in a recent Presidential message, where, touching the coal situation, the President remarks that it is up to Congress, since he now has no power to interfere. This would give the country to understand that the President would like to be given supervision of the industry, an impression which the remarks of the Secretaries of Commercie and Labor at the Mining Congress indicate may not be the correct one. The onus of the job would fall upon these officers; and they see it as impracticable, and do not want it. They pass back the suggestion to the coal men, to put their own house in order; and in this they find the coal industry, both capital and labor, in complete agreement.

Secretary Hoover, in his speech, emphasized the truth that government interference always comes from pressure outside of and upon the government, and not from within the government; that while probably nobody is in favor of a constantly increasing measure of Federal power and Federal supervision of business, yet many groups are continually pressing to have governmental legislation which shall help their own particular industries to some advantages which they cannot gain in fair trade and competition; and that the sum of all this pressure results in a general tightening up of the centralized control. The farmers, of course, or a section of the farmers—or, some say, the country bankers who finance the farmers—are a conspicuous example of a group trying to force the government to enter into business with them and give them an advantage over the other industrial groups of the country. This of course would be pernicious legislation; but it will be aggressively pushed from the agrarian states.

## South African Mineral Production

SOUTH AFRICA may not be so important a source of supply of the world's metals as it is commonly conceived at home, according to a remark of a writer in a recent number of the *South African Mining and Engineering Journal;* but at any rate she is of great and growing importance. Recent statistics show that during the first eight months of 1926 more gold was produced than during the corresponding period of 1925, a record year. Also more diamonds were produced, in spite of the recent published impression of a flattening out of the diamond market; also, more platinum and osmiridium were turned out, and more asbestos, chromite, and corundum. The osmiridium is largely recovered from the treatment of gold ores. About twice as much chromite (by weight) as copper was produced—the production of the latter falling off somewhat. The small production of tin fails to show any advance.

# Pecos Mine: A New Zinc-Lead Project

*Near Santa Fe, the American Metal Co. Has Equipped This Property for a Daily Output of 600 Tons of Ore, to Be Treated by Flotation*

By A. H. Hubbell
Managing Editor

A MINING PROJECT about which little has been heard despite the fact that the company conducting it is now expending $2,000,000 on plant and development is that which the American Metal Company of New Mexico has undertaken at its Pecos mine. Here a deposit of complex zinc-lead ore, long known, is to be exploited.

The Pecos mine is in the upper part of the Pecos

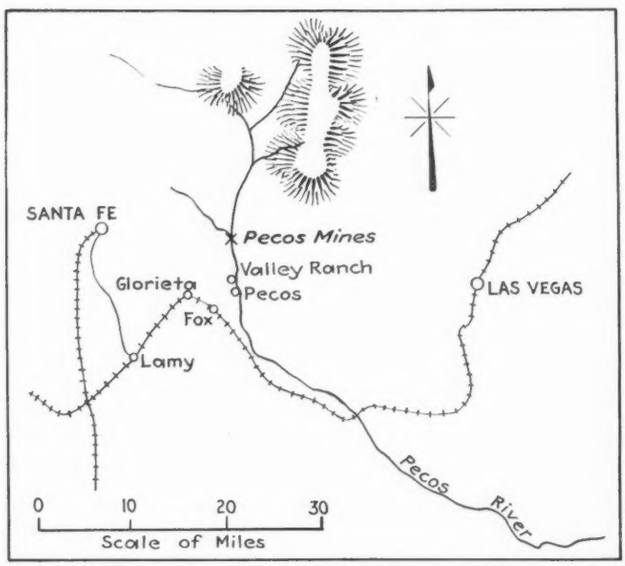



*Fig. 1—Sketch map showing situation of Pecos mine, in New Mexico*

River valley in northern New Mexico, about 15 miles in an airline east of Santa Fe, though more than twice that distance by wagon road. The nearest railroad point is 12½ miles away, at Alamitos, which only recently acquired the dignity of having rail communications when the Atchison, Topeka & Santa Fe ran in a spur from Fox, on its main line 4½ miles away. At Alamitos the mill that is to treat the Pecos ore has been erected. The link between mine and mill is an aërial tramway 12 miles long. Not far from Alamitos is Valley Ranch, a well-known resort, where, for a consideration, one may enjoy the pleasures that life affords in the attractive Pecos Valley. This place, it might be added, is on the route of the so-called "Indian Detour" for tourists, devised by the railroad to exploit the Indian villages and ruins that are found in this section of New Mexico. From Valley Ranch will come the water necessary for milling and power purposes at Alamitos. These various points are shown on the sketch map in Fig. 1.

Opportunity to visit the Pecos mine presented itself through the courtesy of the American Metal Co. about the middle of last October. My observations as given here are supplemented by data obtained from officials and operating executives of the company. It is a pleasure to acknowledge this indebtedness to Dr. Otto Sussman, Messrs. Heath Steele, H. L. Brown, C. C. Hoke, and J. T. Matson, the last of whom is manager of the Pecos property. Acknowledgment is also made to Messrs. W. J. Coulter, the mine superintendent; H. D. Bemis, mill superintendent, and E. C. Anderson, engineer. Access to the report of Mr. Basil Prescott on the geology of the Pecos property was afforded by Doctor Sussman, as well as to the report of Mr. Arthur D. Storke on the mining methods that it is proposed to use. On both of these reports I have freely drawn, as specifically indicated in the following text.

## Deposit Known Forty-four Years

Discovery of the Pecos mine was made in 1882 by one Case, a prospector who came from Kansas. Organizing the Pecos River Mining Co., he sought to develop the property. Soon after it was examined by A. H. Cowles and his brother, and as a result was purchased by their father. In 1886 development was undertaken by A. H. Cowles, who quickly decided that the ore could not readily be handled in this country. Whereupon seventeen years of idleness ensued, lasting until 1903, when Mr. Cowles, having come into control of the property, organized the Pecos Copper Co. Development was then resumed and continued until 1907, when once again work ceased. For the next nine years the property was idle. In 1916 the Goodrich Lockhart Co. took an option on it and pushed development seriously, save during the war period, until 1921. Efforts were bent during the next four years to finding some method of treating the ores. In England, Australia, and on the Continent this work was carried on, and by many in this country. Finally differential flotation yielded satisfactory results. Last year the American Metal Co. acquired the property under option, and after examination by its engineers decided to develop and equip it. A subsidiary, the American Metal Company of New Mexico, is the operating company.

## One Million Tons Developed

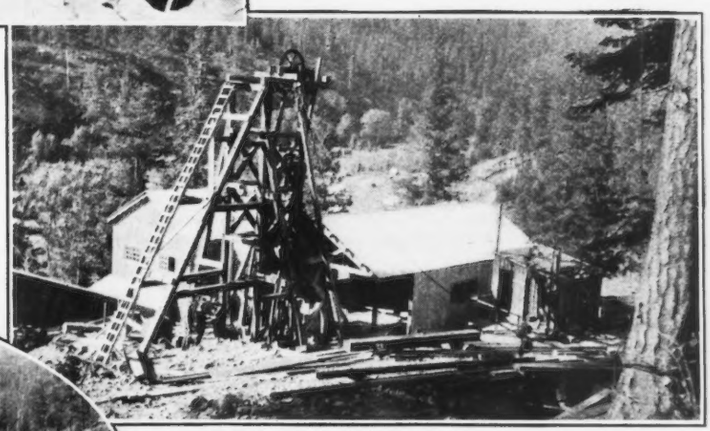
Unlike most other properties with so long a history, the Pecos mine has made no production in the past save for the ore that has been taken out in the course of exploration and development. Two shallow shafts and a few thousand feet of drifts and crosscuts constitute this old development work. To date it is estimated that the amount of ore developed by underground workings and diamond drilling approximates 1,000,000 tons averaging 17 per cent zinc, 5 per cent lead, 1 per cent copper, 3.5 oz. silver, and 0.13 oz. gold. The company engineers have concluded that there is sufficient ore in sight to warrant the expenditures involved in the present program, which is based on a proven five-year life of the mine.

## The Program

The program includes the following:

1. Development and equipping of the mine for a 600-ton daily output. Incidental to this are the sinking

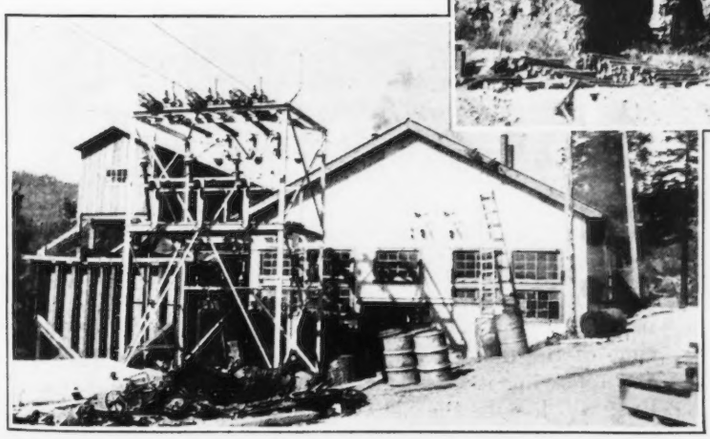
*Loading bin and terminal of new 12-mile aërial tramway between Pecos mine and the mill at Alamitos. At the time this view was taken (Oct. 10, 1926) the tramway was about 75 per cent completed*



*Right—Sinking headframe over the new 375-ft. shaft at Pecos mine. This has since been replaced by a permanent 65-ft. structure*

*Oval—The seat of management at Pecos mine. At the left is seen the office of Mr. Matson, manager of the operating company*

*Right—The old steam plant at the Evangeline shaft. The shaft is entered through an adit on the 100 level*



*Left—Transformer station, hoist and compressor plant, adjoining the tramway loading station, at Pecos mine*

(now complete) of a 375-ft. three-compartment shaft, the construction of a 65-ft. headframe to replace the sinking headframe, and the erection of a hoist and compressor plant, shops, and a warehouse at the mine.

2. Erection of a coarse-crushing plant at the mine.

At the north end, the (Evangeline) ore is more nearly vertical. The orebodies occupy a shear zone that is said to be very wide and of considerable though indefinite length. The wall rock most commonly noted in the Evangeline is a diorite; in the Katydid granite more often forms the walls. The ore is a mixture of zinc, lead, and copper sulphides carrying silver and gold. The average tenor of the two deposits has already been given (on page 1004).

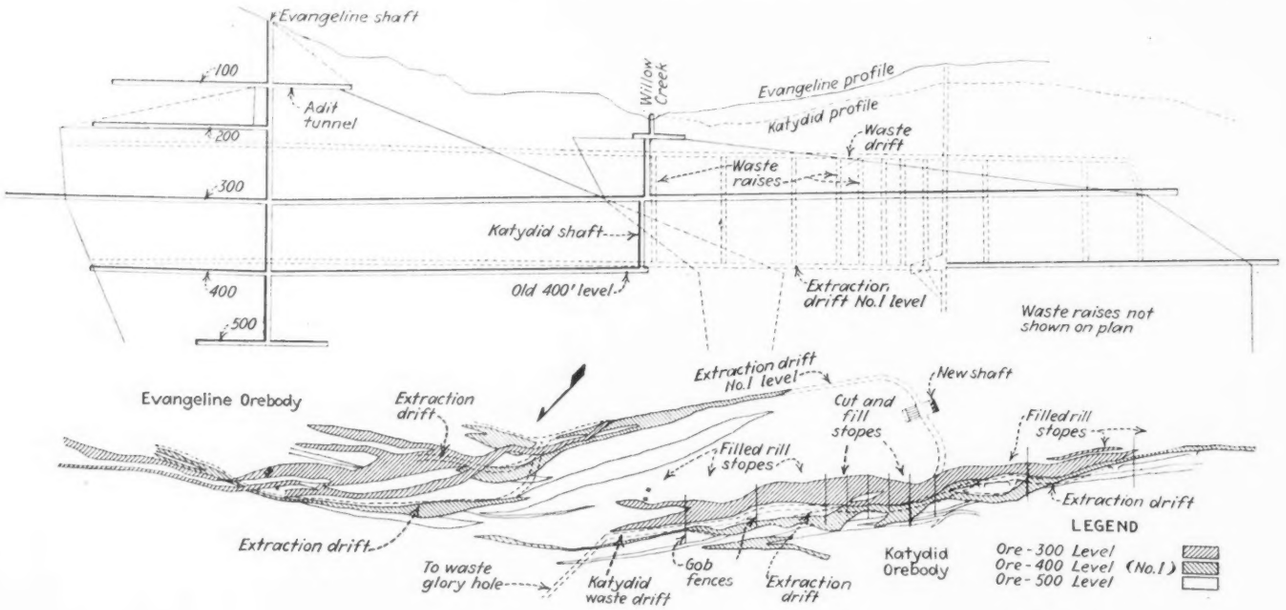



*Fig. 2. Above—Sketch showing old and new development work of Pecos mine projected to the same vertical plane. Below—Horizontal projection of the two orebodies of Pecos mine, showing their approximate outlines on three levels as indicated by development work done to date; also the proposed and waste extraction drifts*

3. Erection of a 600-ton differential flotation mill at Alamitos.

4. Construction of a 12-mile aërial tramway between mine and mill.

5. Erection of a 3,000-kw. power plant, near the mill, with power transmission lines to mine and pumping plant.

6. Erection of a pumping plant at Valley Ranch, 7,000 ft. from the mill, to supply water for power and milling purposes.

7. Construction of a dam to impound tailings and serve as a reservoir. This dam will contain 40,000 cu.yd. of earth.

8. Construction of camp and bunk houses at both mine and mill, and erection of a dry house at the mine.

A preliminary to the construction program at the mine was the task of widening the 12-mile wagon road that extends up the Pecos Valley between mine and mill so that at all points two cars or teams might pass. This included the catching up and underpinning of seven or eight highway bridges and redecking them. A company embarking on such a task as this, a task involving the creating of two or more communities where no settlement has previously existed, also finds it necessary to do many things not directly connected with the mining operation. One of these in the present instance is that of providing school facilities in co-operation with the county.

## Ore Deposits and Geology

Two orebodies closely related to each other in position and ore characteristics and possibly connected below the present level of operations occupy the area to be worked. These are the Evangeline and the Katydid orebodies. The general strike of the deposits is N. 45 deg. E. In the south end (the Katydid) the dip is about 80 deg.

According to Mr. Prescott, the Pecos deposits are situated near the southern end of the main mass of the Pre-Cambrian of New Mexico. This formation is exposed locally only in the canyons of the Pecos River and its tributaries, the rest of the surface being covered by Carboniferous sediments. The ore is found in the Pre-Cambrian and does not extend into the overlying Carboniferous—this because it was on the eroded surface of the Pre-Cambrian that the Carboniferous beds were laid down. Thus the deposits appear to be of great antiquity.

From exposures in near-by canyons Mr. Prescott has formed the opinion that the Pre-Cambrian in the Pecos area is chiefly granite rock. The oldest rock noted seems to be a granite gneiss, not found in the mine, but cut and intruded by a dark fine-grained diorite such as is found underground. Both in turn are intruded by a hornblende granite which completely shattered the diorite; followed closely and cut by dikes and intrusions of the last phase of igneous activity and by acid segregations varying from hornblende porphyry to practically pure quartz.

## Deposits in a Shear Zone

The general northeast trend of these intrusions indicates the existence of a line of weakness approximately parallel to the course of the present orebodies at the time of the intrusion. During the close of this period and following it a shear zone was developed along that line, which with the help of metamorphosing solutions altered the igneous rocks into bands of schists of various types. This shear zone, though faulted, Mr. Pres-

cott says, can be traced with reasonable certainty for several miles and is made up of a number of parallel bands striking N. 45 deg. E., each not generally exceeding 20 or 30 ft. in width, but with a total width of perhaps 2,000 ft.

Accompanying and following the development of the schist, the deposition of ore took place along this shear zone from a mineralizer, the character of which gradually changed over the long period of deposition. The earliest minerals deposited were of a high-temperature sort, such as tourmaline, actinolite, and biotite, accompanied by gold and copper, with much quartz and some pyrite. Later the mineralizer carried chiefly zinc, lead, and iron sulphides with comparatively little silica and no silicates. Throughout this period faulting and minor movements continued.

### Two Orebodies Originally One?

Except for the N. 45 deg. E. shearing, only the movements later than the first of the mineralization are considered of economic importance by Mr. Prescott. For the most part these strike N. 75 deg. E. to east and west. Their movement is nearly horizontal, the individual movements varying from a few feet to 20 or 30 ft. and sometimes considerably more. As a rule, Mr. Prescott says, these east-west faults were post-mineral and cut and offset the ore. In some cases, though, they antedate the completion of ore deposition and occasionally were formed early in the period of mineralization. It is probable that the zone containing the Evangeline and Katydid orebodies was originally a single plane. After faulting, both segments were reopened along their strike, and a fissure, which represents a continuance of their walls, developed to the southwest beyond the Evangeline and mineralized and to the northeast along the Katydid without further mineralization.

### Deposits Apparently Lenticular

The ore seems to occur in lenses along the N. 45 deg. E. fissures, usually in the schist but also in the granite phases, and in the diorite when the schistosity is lacking. Two main bodies, the Evangeline and Katydid, already mentioned, are known and several minor parallel occurrences. The relative position of these is shown in Fig. 2, after a sketch in Mr. A. D. Storke's report on mining methods. The lenses appear to reach their maximum development between the 300 and 400 levels. The lenticularity, however, may be more apparent than real.

Secondary enrichment is a negligible factor in this deposit, in Mr. Prescott's opinion. Although there may be some oxidation near the surface, with subsequent enrichment of sulphides below, he thinks the tonnage of such enriched ore will be unimportant.

### Ore Possibilities

In discussing the possibilities of the property Mr. Prescott points out that toward the northeast (see Fig. 2) the Evangeline orebody seems stronger near the face than between that point and the shaft. On no level is there any sign of diminution in intensity of the mineralization in this direction. Likewise, the southwestern end of the Katydid still offers encouragement to development in this direction. As for the dying out of the mineralization at the ends of these two bodies opposite to those just referred to, this signifies little on the assumption that the two formerly constituted a single zone. As for continuance downward, positive proof has already been obtained of a continuation of at least part of the orebody to a depth of 750 ft., and there is nothing to indicate that it does not go below this point.

Outlying areas also offer possibilities. Exposures in neighboring canyons indicate that the shear zone may extend several miles and that it has an average width of possibly 1,000 ft. On the main shear zone of the property itself only a small width has been prospected. Both north and south are found other small prospects, mostly copper in the same formation.

### Two Deposits to Be Worked As One

The two deposits are to be worked as a single mine under the proposed plan of development and stoping. The new 375-ft. three-compartment shaft, to be used as the main working shaft for both orebodies, has been sunk in the footwall (200 ft. in) of the Katydid deposit. This shaft is 289 ft. deep from the collar to the old 400 level. It has two 5x5-ft. skip compartments and a third compartment 5x7-ft. Two 70-cu.ft. skips in counterbalance are used, each with a cage beneath it. The 400 level, so called hitherto, is now known as the No. 1 level under the new development program (for the plan is already in operation), and on this No. 1 level is being driven what is to be the main extraction drift. This drift will run the entire length of the known mineralized area of the two deposits, connecting with both the Evangeline shaft (Fig. 2) and the main shaft. Through it and its various branches will be taken out all the ore in both orebodies between this No. 1 level and the surface. All mine work is to be done through the new

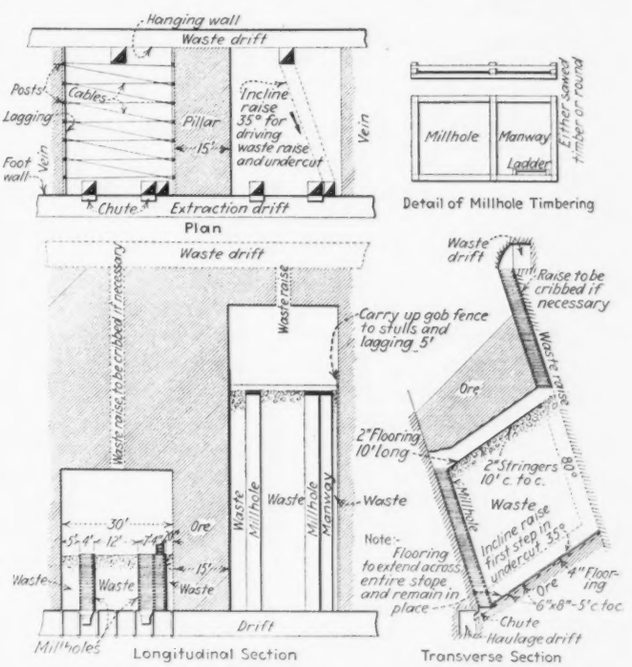



*Fig. 3—Sketches showing proposed incline cut-and-fill method of stoping proposed for Pecos mine*

shaft save pumping, which will probably be done through the Evangeline shaft.

The mining methods to be used will be described later. They include, briefly, the filled rill, the inclined cut-and-fill, and, in the pillars, the Magma top-slicing methods. To provide the fill a waste drift is being

driven 150 ft. above No. 1 level. It will communicate with a glory hole to be started in the hanging. This waste drift is being driven 6x7 ft. in size, and work is being pushed as rapidly as possible from nine separate faces, which were started from both the new shaft and the old Katydid shaft, as well as from various points on the old 300 level. Besides the waste from the glory hole

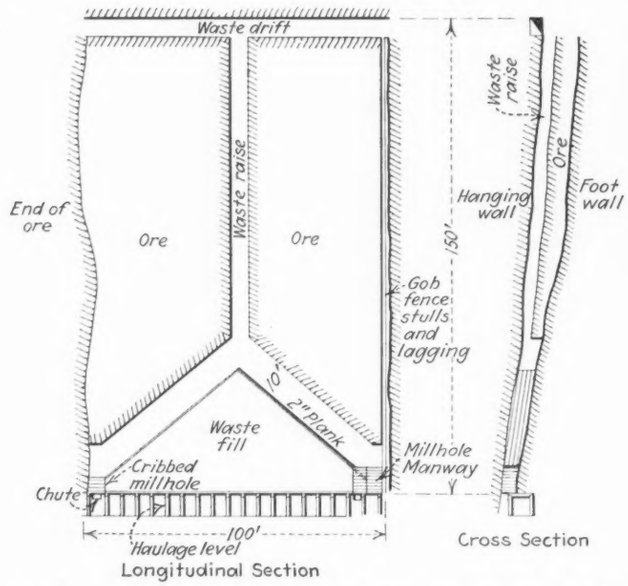



*Fig. 4—Longitudinal section and cross-section of a filled rill stope, according to method proposed for Pecos mine*

all development waste will be used for filling. It will be hoisted when necessary in cars to the waste level.

Such work as hitherto has been done was conducted from a two-compartment shaft on the Evangeline, already referred to as the Evangeline shaft. This shaft is entered through an adit tunnel on the 100 level. A 200, 300, 400, and 500 level were also opened from it. The shaft is 360 ft. deep to the 500 level, where it is bottomed. Save for two short drifts on this level there are no workings below the 400. Below the 400 level the shaft is under water. No headframe stands over the Evangeline shaft—nothing save a sheave, at the collar over which passes the hoisting rope from a converted steam hoist (operated by a 50-hp. geared motor) located at the adit mouth. The shaft and plant will be kept for emergency purposes.

On the Katydid orebody there is also an old shaft consisting of three separate offset sections, from the surface to the old 200 level, 200 to 300, and 300 to 400. Naturally, no work is done in this shaft. The elevation of the collar is considerably lower than that of the Evangeline shaft, so that from the collar to the 200 level is but a short distance.

## Mining Methods Studied

Details of the mining methods proposed are given rather fully in the following paragraphs. It should be borne in mind, however, that practically no stoping has been done as yet and that, owing to the absence of openings on the dip, little is known about the walls save where they have been cut by drifts and crosscuts. It is therefore not at all unlikely that the proposed methods may have to be modified to a varying extent to adapt them to possible conditions that are different from those upon which calculations have been based. In 1920 a careful study of the Pecos deposits was made by Mr. Arthur D. Storke, now manager of the Climax Molybdenum Co., and based on this study a stoping plan was developed which the American Metal Company of New Mexico now proposes tentatively to follow. Figs. 2, 3 and 4 are reproductions from Mr. Storke's report. Likewise the description and discussion of the various methods given are his, though reworded and rearranged in places.

In both orebodies it is known that the ore stands well in drifts without timbers. The ore in the Katydid is firmer and will stand the largest opening without caving. Walls of both orebodies are blocky and are cut with strike faults, which are thought to prohibit shrinkage stoping through the excessive dilution they would cause. Walls of the Evangeline body are much weaker than those of the Katydid, so that greater care will be required in mining the former body. The width of ore that is to be mined varies from 4 ft. to 40 ft., and the irregular outlines as determined by drifts and crosscuts indicate that there will be wide variations in widths of the body in a single stope.

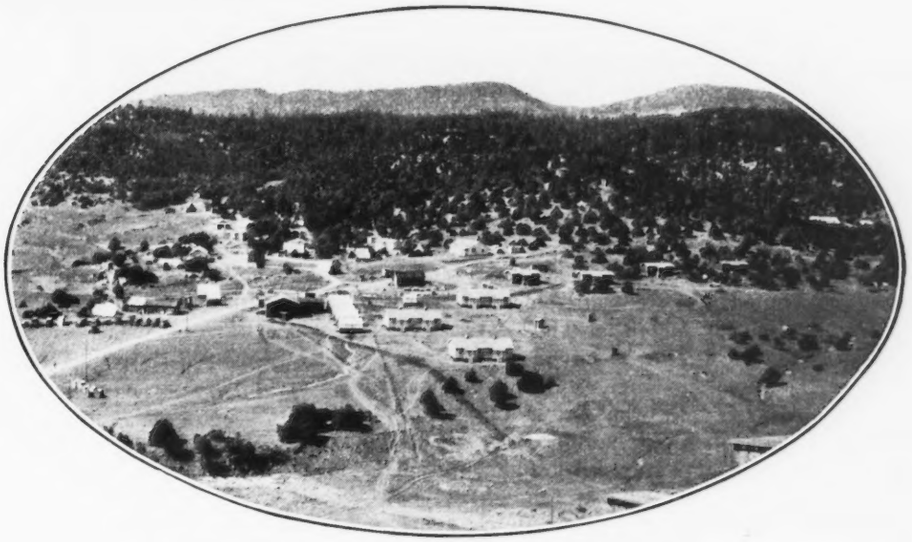
Thus it is apparent that some method must be used that will give secure wall support with as low a cost as is possible with safety, high extraction, and low dilution. Shrinkage stoping, it is thought, would result in high dilution and possible oxidation of sulphides in the stopes, owing to storage. In the wider sections of the veins with weak walls shrinkage stoping would be impossible, as high dilution would certainly result. Square-setting also has been considered, and the method was rejected because its high cost, together with its requirement of skilled timbermen, does not commend its use save where ore and walls are so soft and so heavy that no other known method will apply. Square sets will be necessary in small irregular sections of heavy ground in about 5 per cent of the tonnage to be mined, it is estimated.

## Methods as Proposed

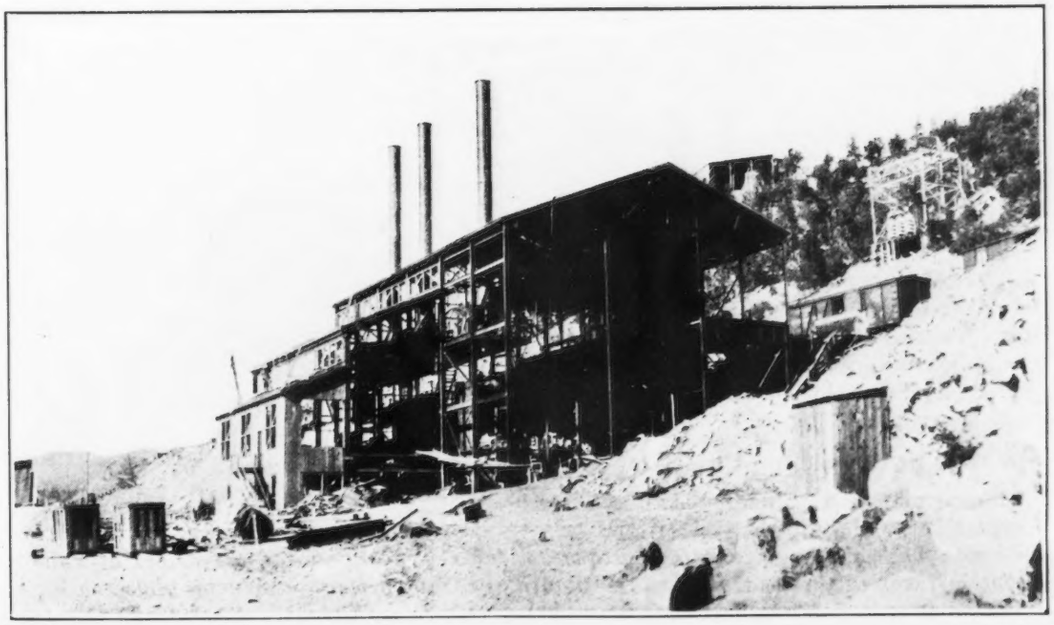
In those parts of the veins where the width is likely to exceed 20 ft. it is proposed to mine the ore by means of incline cut-and-fill stopes positioned with the incline running from hanging to foot across the strike. The method proposed is indicated in Fig. 3 and is described as follows:

The haulage level is driven in the foot and timbered if necessary. With average ground it will probably be possible to carry a stope 30 ft. long. The stope will be started by cutting out ground for two chutes on 16-ft. centers. After these are built, from one of them a raise will be carried up on a 35-deg. incline to the hanging wall in the center of the stope. From this a waste raise will be carried up on the hanging wall in the ore to the waste level above, this raise to be timbered when necessary. The entire stope floor will then be undercut and a floor of 4-in. plank on 6x8-in. stringers will be laid so that the stope from below can be carried up to the fill. Stoping will then be started by taking two 5-ft. cuts in ore. The third round will then be drilled and left standing. The broken ore will be pulled through the chutes and a layer of waste placed through the waste raise. This waste will be leveled, a floor of 2-in. plank laid, and the round already drilled blasted. This procedure will be continued in cycles, carrying up cribbed mill holes and manways as stoping advances. Gob fences must be built on both ends of the fill, so that the succeeding stopes can be carried up alongside of the one

*New 600-ton flotation plant at Alamitos which is to handle the lead-zinc ore from Pecos mine, 12 miles away. On the date when this view was taken (Oct. 11, 1926) the mill was rapidly nearing completion*



*Oval—The mill camp at Alamitos. This view was taken from a point on one of the benches above the mill*



*The new 3,000-kw. power plant at Alamitos. The mill building may be seen beyond it above the roof. This plant is provided with the most up-to-date equipment*

*Building tailing dam across Alamitos Canyon. For this 40,000 cu.yd. of earth has been required. The dam has a core wall of puddled clay*

already mined out. These will consist of 10-ft. vertical posts tied into the fill with old cable or round lagging laced with split lagging or slabs.

When the ground is good (as in the Katydid) it will not be necessary to leave pillars, and one cut-and-fill stope can be carried up alongside of one already completed.

Where the ground is heavier (as in the Evangeline) 15-ft. pillars may be left between stopes and these pillars mined by the top-slicing system of stull stoping developed by the Magma Copper Co. The Magma method is described by W. C. Browning and Frederick Snow in *Engineering and Mining Journal-Press* of Jan. 31, 1925. It consists of milling into a footwall raise and timbering with stulls placed against the posts of the gob fences on either side. A segment set is placed at the top of the stope when the back is heavy. After completion the stope is filled and nearly all the stulls are recovered. In the Magma mine, however, long transfer raises to a lower haulage level are used. These will not be used at Pecos. Another difference is that whereas Magma sills out on the extraction level, at Pecos it is thought preferable to sill out above and take out the pillar from below.

Where the vein is 5 to 20 ft. wide, the use of filled rill stopes has been proposed. The essentials of this method are the same as in the cut-and-fill method just described. The stope will be started with a waste raise from level to level, chutes built, and the ore mined in successive cuts, the broken ore pulled between cuts and the open space filled with waste. In starting a filled rill stope it is considered best to cut out the sill the width of the drift and carry it on timbers.

The proposed scheme of mining, it is thought, will get the company into production quickly and will give clean mining, maximum extraction, minimum dilution, and minimum timbering with a cheap grade of timber, and with safety as to loss of ore and injury to men. It does not call for highly skilled mining labor and permits almost total elimination of shoveling.

### Mechanical Haulage Underground

Maximum length of underground haul is estimated at 1,200 ft. Mancha 2-ton locomotives with Exide batteries (3.4 tons in all) are to be used. The main haulage drift has a grade of 0.4 per cent in favor of the load. The waste drift will be a little flatter. Forty-cubic-feet rocker dump mine cars of the C. S. Card Iron Works Co. will be used.

Drills used underground on development are I-R N70 drifters and CC 110W stopers, the latter in raises.

At present the waste from development is hoisted up the main shaft and dumped near the top of the old Katydid shaft. The development ore is also dumped near by, and is being hand-sorted in preparation for starting the mill. It is preferred to have the mill start on a poorer grade of ore.

### To Flume Creek Over Workings

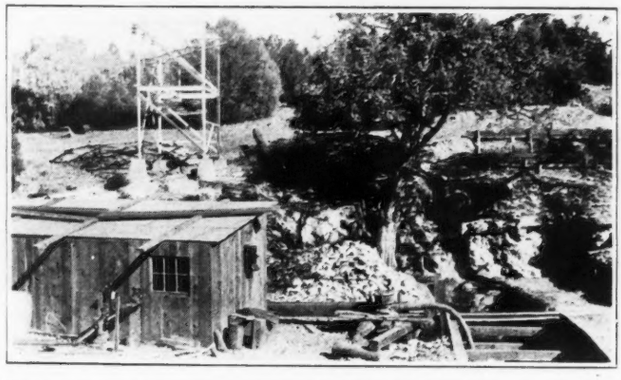
Unwatering of the mine to the old 400 level was completed last summer. At present the pump, an Aldrich triplex, is handling 300 gal. per minute. Considerable water from Willow Creek, a small stream flowing diagonally across the strike (and for a little ways along it) above the Katydid workings to join the Pecos River a short distance below, no doubt finds its way underground. To avoid this, work is under way to dam this creek some distance up its bed above the mine and to flume the water over the workings for a distance of some 2,000 ft. The capacity of this flume is 90 sec.-ft., or three times the average high water in the spring of 1926.

The mine plant is at No. 1 shaft, recently sunk. The new hoist is electrically operated with one rigid and one friction drum, geared to a 150-hp. motor. Rope speed will be 400 ft. per minute, and the rope $1\frac{1}{8}$ in. in diameter and of flat-strand make. The hoist will be completely automatic, with oil braking and Lilly control.

Besides the hoist, the engine house at No. 1 shaft contains one Ingersoll-Rand PRE 2 electric-driven compressor, of a capacity of 2,620 cu.ft. of free air per minute at full load; one 600-ft. motor-driven I-R compressor; one 4-cylinder Fairbanks-Morse oil engine, and one 2-cylinder oil engine of the same make, the two having a combined horsepower of 225. These operate generators.

### Crusher and Tramway

The ore hoisted will be crushed to $\frac{1}{2}$-in. size before going to the tramway bins. This will be done in an 18x30-in. Allis-Chalmers jaw crusher followed by a Traylor Bulldog gyratory and rolls. The tramway, of Riblet construction, is now practically completed. It is about 12 miles long, having one angle point with a double control station. It will be operated by a 100-hp. motor at a full speed of 500 ft. per minute. Its capacity will be 60 tons per hour, 10-cu.ft. buckets being used with



*Excavation for new pump station (at right) at Valley Ranch and transformer station as it appeared in October*

a 300-ft. spacing. It contains two spans that are over 4,000 ft. in length. Four hundred buckets will be used on the tramway.

### Mill to Start Jan. 1

The mill and power house have been located at Alamitos, 7,000 ft. from Valley Ranch. Tailings disposal would have been difficult at the mine, which is in a narrow section of the Pecos Valley. The ratio of concentration figured on is to be approximately 2½ or 3 into 1, so that in any case some means must be provided for moving a large tonnage to the railroad. Furthermore, the water necessary for power and milling purposes is obtained from Valley Ranch.

In the mill, which is to be of 600 tons' capacity, differential flotation followed by tabling will be employed. The flow sheet accompanying shows the equipment and the present proposed method of using it. It is likely that there will be changes in this flow sheet, possibly even before starting. Already there have been several. Marcy mills will be used for grinding in closed circuit with Dorr rake classifiers. The flotation machines will be of the Mineral Separation Sub A type on both the zinc and lead circuits. The first six cells on the zinc machines will carry spitzes. Oliver filters will be used for drying the concentrates.

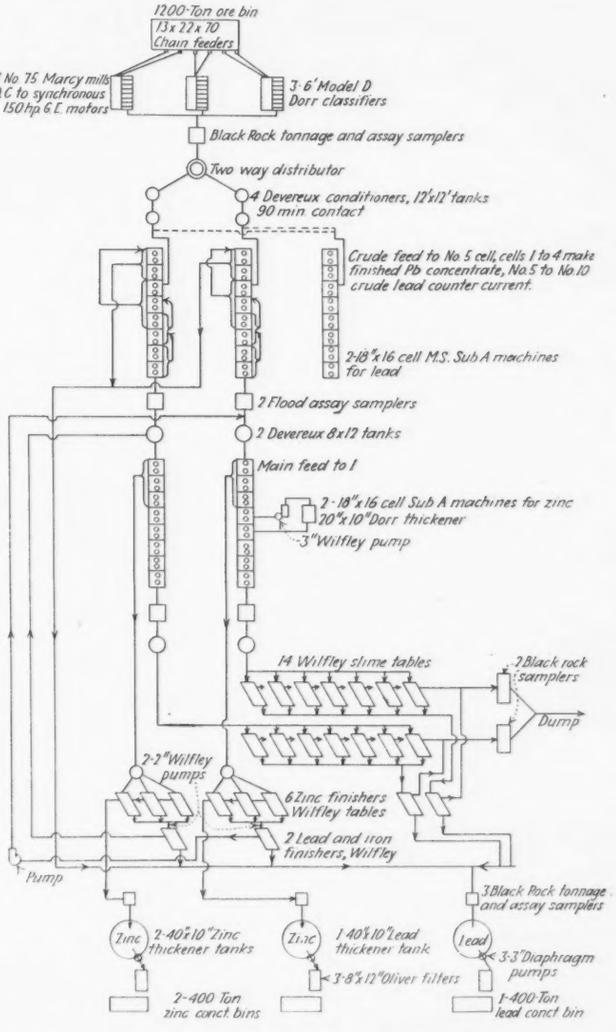
The ratio of concentration, as previously stated, will be low—2½ or 3 into 1. Production of concentrates is expected to amount to about 4,500 tons monthly of zinc concentrates averaging about 52 per cent zinc, 0.8 per cent lead, 2.08 per cent copper, 7 per cent iron, 3.86 oz. silver, and 0.14 oz. gold. An iron concentrate running about 45 per cent iron, 0.6 oz. gold, 2.5-3 oz. silver, and 0.25 per cent copper will probably be made. It has not yet been decided whether the lead concentrates will be cleaned as against copper and iron, producing a higher lead concentrate and a copper concentrate running 17 to 20 per cent copper. This will not be determined until the mill has been running and the most economical procedure established. To what point the concentrates will be shipped has not yet been decided. This may be either Langeloth, Blackwell, or Bartlesville, Okla. An effort is being made to have the plant going by Jan. 1. This, at full capacity, is impossible, but one unit will be running.

### The Power Plant

Close to the mill, on a similar side-hill site, is the new 3,000-kw. power plant. Erection and operation of this is under supervision of C. C. Hoke, of the company's Monterey (Nuevo Leon) office. Coal is delivered by the Santa Fe railroad to steel bunkers on the tracks. It is ground in Aero unit pulverizers, each with its own magnetic separator for protection against tramp iron. Dead coal storage is also provided, with magnetic protection and elevators to pick up the coal again.

The boiler layout consists of three 346-hp. Springfield boilers. The horsepower rating is figured on a 10-sq.ft. basis. Foster superheaters are provided to give 200 deg. of superheat at 250 lb. pressure. Preheated air is used in the pulverizers. An American blower furnishes induced draft for each boiler. High-pressure (Kellogg Co.'s) piping is used throughout. The generating equipment consists of two 1,500-kw. G.E. turbines, 80 per cent power factor (or 1,875-kva. machines), 3-phase, 60-cycle, 2,400-volts. Worthington surface condensers are used, and Spray Co.'s cooling equipment and air washers. Hoppe's open feed-water heaters are installed and turbine-driven centrifugal feed pumps (Bethlehem Shipbuilding Corporation). Electrical equipment is General Electric throughout. Names of the makers of the equipment used are given both here and elsewhere, where known, with the idea that in the description of a new plant such information is of interest to the reader.

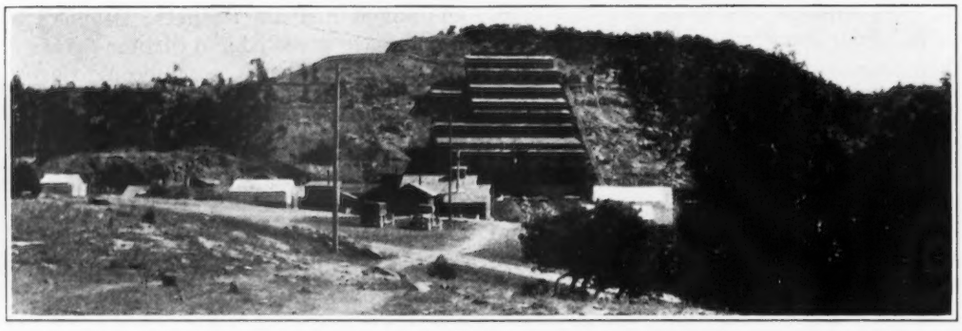
Power is generated at 2,400 volts (nominal), which is stepped up to 22,000 volts for the mine and river pump stations. It is stepped down again to 2,200 volts.




*Tentative flow sheet of Pecos mill, that was under consideration in October. A third unit is partially indicated*

All motors over 50 hp. at mine and mill are 2,200 volts; all under 50 hp. are 440 volts. All transformer substations are of the outdoor type. That at the power plant is 2,000 kva.; at the mine 1,500 kva.; at tramway 225 kva.; and that at the river pump station is also 225 kva. A power transmission line runs from the power plant to the mine and another to the pumping plant at Valley Ranch.

The power plant is of steel construction on concrete foundations. It is inclosed in corrugated iron except on the side against the switchboard and turbine bay, which is sheathed with lumber to reduce condensation and make this section of the plant warmer. The power



*The new Pecos mill, from the camp at Alamitos*

plant was designed in the Chrome, N. J., office. Provision has been made for another turbine unit and one more boiler.

Hot water for the mill pulp is taken from the turbine condenser circulating system discharge. It would be desirable to have water at 100 deg. F. for the mill all the year, but it is expected to give the water at 85 to 100 deg. F. Two Allis-Chalmers 400-gal. centrifugal pumps have been installed for this service.

### Water Supply and Dam

The water supply for mill and power plant is to be pumped from the pumping plant now being built at Valley Ranch on the Pecos River 7,000 ft. away. The installation will consist of two 450-gal. Aldrich triplex pumps working against a 650-ft. head. Each of these will be operated by a 100-hp. motor with a Morse silent-chain drive. Water will be allowed to seep into the sump from the river by infiltration through a gravel and boulder barrier. On a bench outside the mill and about 40 ft. above the ball mill floor two 143,000-gal. tanks have been installed.

A dam is being built across Alamitos Canyon to impound tailings and serve as a reservoir. It will hold 350 acre-feet of water on an 8-ft. freeboard and will back up the water 2,600 ft. Its construction involves the movement of 40,000 cu.yd. of material. It has a 12-ft. core wall of puddled clay. The dam is not in the path of any wave action, but is around a bend. No riprap is used, though it can be added later if found necessary.

Bunkhouse accommodations have been provided for about 200 men. In addition there are some old houses. At the mine five eight-room houses, each room with an outside door and each accommodating two men, have been built at a cost of $125 per man, which the superintendent claims is considerably less than a bunkhouse of the usual type and same capacity would cost. A dry for 100 men has also been erected with showers, lockers, and means for hoisting clothes overhead and locking them so that they cannot be lowered, except by the holders of the keys.

A force of 200 to 275 men will be employed on all operations, the company expects. Of these 200 will be engaged in the mine and the remainder in the mill, power house, tramway, and other departments. It is likely that, barring unforeseen obstacles, the entire project will be functioning early in 1927.

## Handling Coal at Port Kembla Docks

AN INTERESTING INSTALLATION of material-handling equipment is that at Kembla, a port in southeastern Australia, where coal is mined and shipped by boat from the southern fields. It was decided to install a belt-conveyor system on a jetty of light construction rather than to erect storage bunkers at the berthing position of the ships and deliver the coal to the vessels by trucks on rails.

At the shore end of the jetty is a feeder bin of thirty-five tons' capacity, into which the coal is dumped from railroad cars. From this bin the coal is discharged through four chutes to a steel flight conveyor running parallel to the track. From the flight conveyor the coal discharges upon the main conveyor belt and is carried out to the ship's side, where it is transferred to another conveyor at right angles and discharged through an adjustable chute into the hatchway of the vessel.

The distance from the flight conveyor to the end of the jetty is 1,400 ft., and to handle this long carry the main conveyor is built in two sections, the coal being passed along from one to the other. These conveyor belts are made of rubber and canvas duck, 36 in. wide, suitably counterweighted to compensate for stretching and to avoid slipping in wet weather.

Two steel travelers, 46 ft. high, provide the means for delivering the coal into the vessels. Running on rails the entire length of the ocean end of the jetty, they may be brought to the most convenient position for loading, and either one may be used separately, or both together.

The flight conveyor is driven by a 30-hp. variable-speed motor, operated by a contactor panel and controller. The shorter section of the main conveyor is driven by a 70-hp. motor and the other by a 100-hp. motor. Each traveler has a 10-hp. traversing motor, a 25-hp. motor to operate the boom, a 10-hp. motor for handling the chute, and a 20-hp. motor for the boom belt. All these motors are of the G.E. slip-ring induction type. The belt motors are under push-button control so interlocked that the boom belt is the first to start, then the ocean end of the conveyor, followed by the shore end of the same and, last, by the flight conveyor.

Electricity is generated in a power house 300 yd. from the jetty. Two Browett & Lindley compound engines are direct-coupled to 300-kw., 2,300-volt, 3-phase generators made by the British Thomson-Houston Co., of England. Babcock water-tube boilers are fed from a reservoir erected in the hills adjoining, and circulation water is taken from the harbor.

# The Oil-Shale Industry*

*A Critical Study of Its Present and Future Possibilities—*
*Its Relation to Petroleum*

By Guy C. Riddell
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*Guy C. Riddell*

FOR the past ten years most of the literature dealing with oil shales has begun with a statement showing the rapid decline of our petroleum reserves and a similar increase in consumption of petroleum products. The reader is then expected to infer that upon the imminent exhaustion of the supply, oil from oil shales will forthwith be used. I would like to examine with some care the state of the world's present and future—from a petroleum point of view—in which this new shale industry is finding its place.

The history of the petroleum and coal industries in the United States reveals an astounding disregard for the conservation and efficient utilization of fuel resources that cannot be replaced. Billions of cubic feet of natural gas and millions of barrels of petroleum have been wasted. Improper drilling and production methods have caused losses that are beyond accurate estimate. There has been waste in refining, and the utilization of petroleum and its products has been notably inefficient.

## Research Only Recently Begun

Research in any organized sense has but just started in the petroleum field. It is an extraordinary thing that an industry of such major importance should have gone on through these last fifty years with so little of the intensive scientific research that is found in the other chemical and metallurgical industries. Methods of producing, refining, combustion, and utilization have improved, it is true, but no real, widespread effort to conserve petroleum and its products has been launched, until comparatively recently. We have come to the present day with production methods that recover 20 to 25 per cent of the oil we find in the ground. Tomorrow morning, if we uncover another large pool, there will be a rush and a hullabaloo, followed by overdrilling in a scramble for the supposed benefits of flush production, and wells of large production will be brought in before storage and transportation facilities are adequate.

The quantity of oil burned as fuel for steam-raising, domestic heating, and like purposes continues to increase—an economic trend in which we find convenience and conservation in serious conflict. Oil fuel should be burned only in internal-combustion engines. We have coal supplies that are good for centuries. It is possible that in fifty years ground-well petroleum in these United States will be a curiosity.

## The Oil Board's Report

For the last ten years, with the single exception of 1923, our domestic consumption of petroleum has exceeded our production of crude. Now comes the Federal Oil Conservation Board to tell us that the "total present oil reserves in proven sands of the United States have been estimated at about 4½ billion barrels—theoretically six years' supply. More than one-half of the current production is coming from about 4 per cent of the producing wells and from fields that have been discovered within the past five years. As a matter of fact, 80 per cent of the slightly less than 300,000 wells in operation are delivering oil at the rate of less than one barrel each per day; of the remaining 20 per cent of the country's oil wells half, or 10 per cent, are producing at not far from the rate of 20 bbl. per day and the remaining 10 per cent, embracing the leading fields of the country, may be averaging as much as 50 bbl. per day each. The average of the entire lot is less than 7 bbl. per day."

The board goes on to say, "Future maintenance of even current supplies implies the constant discovery of new fields and the drilling of new wells—in other words, the maintenance of the exceedingly large ratio of flush production." Hitherto there has been no failure to discover such new fields as were required. Of late there is a disquieting absence of important new production. More than 20 per cent of the 680,000 wells that have been drilled in this country during the sixty-seven years since Drake put down the first well in Pennsylvania have been dry holes. A year or two ago approximately $100,000,000 was spent annually on dry holes—$10,000 to $100,000 a hole. I venture to say that if today's figures were known, we are spending two or three times this $100,000,000 a year in our determined, but unsuccessful, effort to discover new, major petroleum pools. In one California field, not so long ago, one of the Standard companies spent $1,000,000 drilling five holes, without securing a drop of oil.

## One-third of Total Production in Last Five Years

To date 9,000,000,000 bbl. of crude oil has been produced in the United States; one-third of it in the last five years. We are producing about 70 per cent of the world's oil and consuming about the same percentage. The United States has 75 per cent of the world's motors, and is more dependent upon petroleum than any other nation.

We should not draw the inference from the report referred to on reserves that the remaining supply of well oil in this country will be exhausted in six or seven years, for this is decidedly not the case. The inference

*A paper presented at the meeting of the Mining and Metallurgical Society of America on Oct. 14, 1926.

is only that each year will widen in an accelerated ratio the gap between domestic production and consumption. It is probable that petroleum will be produced in the United States for fifty years or more, but in smaller amounts each succeeding year after the peak of production has been passed. There is every indication that this peak is close at hand, if indeed it did not occur in 1925.

Production engineers are devising new and improved methods whereby some of the 75 per cent which is left in today's sands can be recovered. I believe it can be said conservatively that we shall never obtain better than a continuous 40 per cent average recovery from underground. These improved extraction methods and the livelier importation of petroleum from foreign fields will fasten upon the commodity considerably increased costs before the years run far. The day is drawing near when the petroleum industry will no longer provide for us the cheapest product in general usage in America, relative to pre-war price standards.

In somewhat extreme phrasing, it was stated in a report on international fuel resources at the international convention of the American Gas Association on Oct. 11 that "Americans are living in an age of fuel folly in which the peak of oil production and oil prices for all time in the United States may be reached in another twenty-four months. The industries consuming oil in the future will be only those that cannot substitute a cheaper fuel." The report goes on to say: "The use of oil for domestic and industrial heating will end completely. We may discover new oil pools and bring about the development of an oil-shale industry, and perhaps establish plants where oil will be obtained from coal, but all these things will not be sufficient to prevent our having to face a real emergency in the matter of liquid fuels and lubricants."

I am sorry to have inflicted all these glittering generalities on you; I am supposed to be talking about oil shale; but it is this background that gives us the necessary perspective on shale oil; we cannot gage the stature of our new industrial giant except we measure it with exactly these world conditions in mind. The oil age has many an economic evil in its system, but the oil age is here, and America is on wheels which must have propulsion and lubrication.

## History of Shale Industry Stretches a Century Back

Born almost a hundred years ago in France (1838), the shale industry quickly spread to Scotland (1850) and to the United States (in the middle of the nineteenth century). In Scotland it took hold substantially, and for seventy-five years has enjoyed a hale and hearty existence, terminated only by the exhaustion of raw material in a local resource never of great extent. The shale pits of Scotland have become mines 3,000 ft. deep, with a mining cost of 8s. per ton. The goodly content of oil in the original beds has dwindled with the years to a maximum today of 15 gal. per ton. The industry in Scotland passed into history a year or two ago.

In America a start was made out in Utah in the '50s and in Pennsylvania a little later. These first efforts would undoubtedly have led to a commercial development of shale oil had it not been for the discovery of petroleum in Pennsylvania in 1859. No humdrum factory production of oil could withstand the liquid-gold fever of the lusty oil-well days that then began. Shale oil, thrust back into disuse for half a century, is now slowly, surely coming into a renaissance that must—not may—endure for many, many years, with a sphere of activity that will take in every corner of the globe.

The record in the United States reflects the history of the industry. From 1858 to 1925 there have been one hundred eighty-six patents issued for oil-shale processes. In 1858 five were issued and up to 1864 there were fifteen more. From 1864 to 1891, a space of twenty-seven years, no shale processes were patented. From 1891 to 1914, a twenty-three-year interval, ten came out and from 1915 to 1919 thirty-four new oil-shale processes were patented. The next five years, 1919 to 1924, saw 107 more patents granted. But few patents have been taken out during 1925 and 1926—approximately fifteen having been issued in 1925.

## Shale Oil in Commercial Use

The year 1926 has recorded some surprising things in the oil-shale calendar. It is during this year that the first pipe line built solely for shale oil has been completed. One of the largest oil companies in this country has built this pipe line in California, because that oil company desires shale oil and knows it can get shale oil. In this same year a leading petroleum company has closed a contract to purchase 10,000 bbl. of shale oil a day. At the present moment, shale oil is being used in metallurgical flotation from Alaska to Bolivia and by a list of companies that includes the largest mines and mining companies of the United States. For some time past, one of the smaller Western railroads has been using, day by day as fuel for its locomotive boilers, shale oil produced in California. Last week [the first week of October, 1926—EDITOR] saw the shipment of the first tank carload of oil extracted at the government's new oil-shale plant at Rulison, Colo.

## What Is Shale?

Now then, what are some of the conditions in this shale industry? What is shale? Where is it? How much of it have we in the country? What is the nature of the process and plant used? What sort of oil is shale oil? What does it cost to produce it? What effect on the refining industry will it have? What about byproducts? When may we look for the oil-shale industry to get a real foothold? Must it wait for high-priced oil?

Shale itself, to put it exactly, is "a sedimentary rock, yielding over 33 per cent ash and containing organic matter that yields oil when distilled, but not appreciably when subjected to the ordinary solvents for petroleum." Oil shale contains no oil as such, but does contain an organic substance termed "kerogen" that yields the carbon, hydrogen, and oxygen that condense as the complex molecules of petroleum. Kerogen (a Greek word meaning "producer of wax") is itself a large complex molecule composed of carbon and hydrogen, with oxygen, nitrogen, and sulphur as minor constituents. Kerogen has undergone considerable chemical study without much satisfactory result. In the Scottish oil it has been more or less isolated as of the composition $C_6H_{10}O$.

Where is this oil shale and how much of it have we? The oil-shale deposits of the country are in two major occurrences; one in the West, one in the East. The Western deposit—known geologically as the Green River formation—runs for several hundred miles in a northeast-southwest direction from Wyoming through Col-

orado into Utah. There are quantities of shale in this deposit that can only be expressed in astronomical figures. This Western deposit is receiving more attention among oil men than is the other great field of the country, which lies just west of the Appalachian mountains in the Kentucky-Ohio-Tennessee region.

### Reserves

The amount of known shale available in the United States has been placed by the A. P. I. Committee of Eleven at some 400,000,000,000 tons. The figures are so large that it is hard to visualize the quantity. I have an opinion of my own that there are perhaps twice as many tons of usable oil shale in this country as that estimate indicates. No one knows and no one ever will know how much oil there is in all this shale, until extensive core drilling of these reserves has been done. Today this core drilling has not even started, practically speaking, but hundreds of superficial samples and surveys (government and private) have fairly well indicated the minimum oil content of these shale reserves. I estimate from personal examination of the major deposits that we can recover from one-half to one barrel of oil per ton from areas that can keep us busy for one or two centuries of steam-shovel operation. Other hundreds of billions of tons of shale that do not lie suitably for steam-shovel handling will wait for the exhaustion of the cheaper deposits.

### Nature of Processes

A word as to the nature of the processes used. In general, these may be rather loosely divided into three classes: externally heated, internal combustion, and fractional distillation (so-called). Continuous feeding and discharging have been tried in each type of process. By far the greatest number are externally heated, among these the Scottish. The Scottish (Pumpherson) retort consists of two sections; the upper section of cast iron and the lower two-thirds of firebrick. The shale is fed continuously through the retort at the rate of approximately four tons per day. Most of the oil is formed in the upper cast-iron section, where the temperature maintained is relatively low, averaging around 1,100 deg. F. In the brick portion, the spent shale is heated by external firing to a final temperature of approximately 1,800 deg. F. and is steamed for the production of ammonia. The amount of steam used is about 900 lb. per ton of shale distilled. In the Scottish plants, sulphate of ammonia is a major product, and for this reason the use of steam at the high temperature mentioned is necessary, as it increases the yield of ammonia many times over that obtained otherwise.

### Combination of Retorting and Refining to Be Avoided

The fractional processes are externally heated and attempt the combined distillation of raw shale with the direct separation of gasoline, kerosene, lubes [lubricants], and other products in one operation. Whatever the future art may hold for this line of effort, it is not working out satisfactorily in today's trend. Those of us who have progressed furthest commercially in the new industry have found that shale oil should be produced in as nearly its formative state as possible and then refined under controlled conditions. This, rather than that a combination of retorting and refining, should be attempted. Where this combination is attempted, it means overheating and cracking of the first-formed oil under conditions not favorable to the production of highest quality products—usually with an increase in the percentage of undesirable, unsaturated hydrocarbons. Furthermore, it has been established by Bureau of Mines tests that the theory of "fractional eduction" of shale oil is not valid from a commercial standpoint. The Bureau states that "no theoretical nor experimental evidence exists to indicate that oil shale produces a preponderance of the low-boiling distillates at low temperatures of retorting and of the heavier, higher-boiling fractions as the retorting temperature rises." It is probable that what is going on in the so-called fractional distillation processes is in reality fractional condensation of the total volatiles rather than anything approaching commercial fractional distillation.

### Eduction by Internal Combustion

This brings us to the simplest form of shale-oil eduction—internal combustion—a system which has already advanced to a commercial position. This method—not unlike the Dwight-Lloyd roasting process for sulphide ores—functions as follows:

The shale is transported from the mine or pit over standard-gage track in a steel car of 40 tons' capacity to a position directly over the charging door at the top of the generator—a brick-lined vertical steel cylinder 11 ft. in diameter, 24 ft. high—and charged into the generator from the hoppers at the bottom of the car. The generator charging door is then closed and gaseous combustion initiated above the charge, the gases being those produced during the distillation of the shale. The quantity of gas and air is regulated by valves and the mixture usually consists of approximately 60 parts gas and 40 parts air, depending on the type of shale being distilled and the B.t.u. value of the gas. A valve connected with the bottom outlet of the generator is opened the proper distance and the draft gases are caused by suction to pass downwardly through the charge. The common gas and vapor pipe is under partial vacuum and connected with standard scrubbing and condensing units as well as a fan-type gas exhauster.

The down-traveling draft gases set up a zone of partial combustion in the spent shale, which travels from the top to the bottom of the charge. Preceding this zone of partial combustion and at some distance below it is a zone of distillation which also travels from the top to the bottom of the generator, the temperature of distillation being approximately 800 deg. F. Preceding and below the zone of distillation is a zone of drying and preheating in which the oil vapors are cooled almost immediately after their formation.

As a result of the producer-gas reaction, which is set up in the incandescent charge and which is highly endothermic, the gases leaving this incandescent zone are greatly reduced in temperature, and it is possible through control of the air and gas mixture to cause the temperature of the gases leaving the producer-gas zone to remain relatively constant at the desired temperature.

### Character of Oil

As to shale oil itself, it is in every essential the equivalent of ground-well petroleum, except that it carries a heavier proportion of unsaturates. Its principal components include various members of the two principal series of hydrocarbons, the aliphatic or open-chain compounds, and the aromatic or cyclic compounds. It

always contains a high percentage of unsaturated hydrocarbons, often as high as 90 per cent.

The statement can be definitely made that shale oil is refinable, and, so far as is known, every product now produced from ground oil can be furnished from shale oil. The composition and in some cases the properties will be different, but so far as the use of the products is concerned industrially, the requirements can and will be met; in other words, lubricating oils, greases, motor fuel, gasoline, kerosene, fuel oil, paraffine, and other like substances of good quality can be produced. There is good reason to believe that the motor fuel will be superior to that now on the market, both in point of power and in anti-knock qualities. Shale oil can be cracked by any of the well-known cracking processes and a high yield of good grade motor fuel obtained. The motor fuel from California shale oil will contain some sulphur, although not an objectionable amount. In every other respect it conforms to the new Navy specifications.

### Refinery Modifications

Though in some quarters there is an idea that the refining of shale oil will require considerable expenditure in the modification of existing refineries, I believe it will be found that changes required in the equipment used for refining ground oil will be slight, when shale oil in sufficient quantities to enable capacity operation is furnished. The temperature and specific gravity at which the various fractions are cut will be different and the chemical treatment of the products in refining will be but slightly modified.

Already the cracking of shale oil crude derived from Colorado, Utah, California, France, Australia, Esthonia, and Italy has established the fact that these cracked shale oils lend themselves to the usual chemical treatment of a petroleum refinery without any special difficulties. The cracked products can be refined by the usual chemical reagents of sulphuric acid, caustic soda, sodium plumbite, water and steam distillation, into marketable gasoline. Standard refinery equipment can be utilized in the chemical treatment of cracked shale oil in the same routine manner as for various cracked products derived from petroleum.

Moreover, the cracking reaction may be so controlled in the treatment of any crude that the non-detonating hydrocarbons can be produced in relatively high percentages in comparison with the quick-exploding paraffin hydrocarbons, and in such quantities that they can be extensively blended with straight-run gasoline so as to improve its burning qualities. Shale oils are themselves rich in unsaturated hydrocarbons, and gasolines derived from shale crude have a utility of major import in the operation of high-compression motors, due to their non-detonating tendency. Motor spirit that is made from shale oil will take an important place in the present widespread demand for anti-knock gasoline. The Cross Engine Testing Laboratories at Kansas City have found that 20 to 25 per cent greater power is obtained from shale oil gasoline than from the average petroleum brands. This is due to the fact that higher compression can be used in engines running on shale fuel. Shale gasoline should command much the same premium that is now given to various anti-knock mixtures and dopes on the market.

Unsaturates are thus not entirely a disadvantage in motor fuels. Nor is sulphur. Nor are the colors that these unsaturates give to the motor distillate. "Water white" is a specification that will fast retreat to the limbo of things forgotten. There is, however, a certain small percentage of shale oil unsaturates that polymerize and oxidize and on standing give rise to gums and resins. These harmful unsaturates may be eliminated by sulphuric acid treatment.

It is known that the motor spirit that is produced in the Scottish industry carried regularly about 60 per cent unsaturates, and it has been stated that this Scottish motor spirit was always in great demand, finding a ready market among the larger trucking companies close to the plant—in preference to the standard refinery spirit at the public distributing stations.

Not only is there nothing serious or costly to be overcome in the treatment of shale crudes, but it is a fact that the appearance of steady quotas of shale crude at refineries will result in some sharp advances in the refining art. There is a splendid chance for attacking certain definite refining problems, such as:

1. Hydrogenation or saturation of unsaturated compounds.
2. Determination of the resin-forming compounds in oil and methods of removing them without removing harmless (olefin) unsaturates.
3. Increased recovery of acid and alkali from refinery sludges.
4. Cheapened, continuous methods of refining.

The installation and operating costs of a shale plant can now be very definitely stated. In comparison with ground well production, the position is almost startling. Per barrel-day, a shale plant of the internal-combustion type costs $450 (for shale assaying 42 gal.), in comparison to the $3,000 figure ordinarily involved in the transfer of ownership of producing oil wells. This $450 per ton or per barrel-day is for the rapid, internal-combustion process of shale-oil eduction; the slower, externally heated, Scottish (Pumpherson) retort runs about $2,000 per ton-day.

### Cost per Barrel Under $1 in One Case

Actual operation of a commercial shale plant for the last three years in California has established the fact that it is possible to produce and market crude shale oil at a cost of slightly less than $1 per barrel, including all overhead and fixed charges—on a 1,000-ton-per-day, steam-shovel basis. This is so far below the average cost of American well oil that the competitive position of shale oil can no longer be questioned; it is an industry for which petroleum economics are ready today. Some of you will recall that the A. P. I. compiled an average cost of $2.17 per barrel for all of the oil produced in the 300,000 United States wells that were operating during a recent two-and-one-half-year period.

### Byproducts

Oil-shale skeptics have for years satisfied themselves with the seemingly unanswered dilemma of spent shale disposal. As the technical aspect of the eduction problem has worked out into a satisfactory position, the spent-shale part of the picture has cleared up nicely. Today there exist two or three outlets for great quantities of spent shale. It will go into the pressed, refractory and insulating brick and tile manufacture; it will provide the clay for certain cement plants; and it will be consumed in fairly large quantities as filler material for the complete fertilizer mixtures of the agricultural industries. Several lesser uses have been found locally in different sections of the country—concrete

building blocks, road material, and as a carrier for nicotine-sulphate insecticide in the West, and also as a filtering material in the sugar industry. In the long run, however, when hundreds of thousands of tons of shale are processed daily, there is, of course, no alternative but to convey the greater proportion of the spent residue to dumps. This can be done for from 4c. to 12c. per ton.

### Shale Field vs. Oil Field

There is an interesting relation between an oil-shale field and a regular oil field. These two petroleum resources differ only as to a place of completion. In a normal oil field, natural forces have assembled the components of petroleum underground, and the tectonic forces of the earth's crust have generated heat and pressure which has converted these organic and plant remains into petroleum ready for the driller. In the case of an oil-shale field, these same oil sands are found at the surface of the earth, having the same plant and animal remains and waiting for someone to come along and provide artificially the heat to convert the kerogen into petroleum. This is, after all, what the oil-shale process does, and this only.

Although so similar in geological aspect, the two are far apart in economics. In the case of an oil field, when the geologist has completed his work the best he can do is to report that he has determined a closed structure and that oil may possibly be found at an approximate depth in a certain formation. In other words, a scientific guess has been made, based upon all available data, but a guess nevertheless.

In the case of the oil-shale field, guesswork gives way to exact knowledge. Besides the sampling of exposed strata, diamond drilling over an extended area with the analysis of every stratum passed through gives positive knowledge of the depth, thickness, and oil yield of each bed, as well as the location of faults, folds, or other irregularities not apparent at the surface. An engineer's report on the oil-shale field, condensed of course, might be substantially as follows. The figures used are approximate and rough, but they are not far from reflecting conditions in certain of the Utah fields.

The 1,000 acres examined show 100 ft. of oil-bearing shale strata amenable to steam-shovel mining, that yield 10 to 70 gal. per ton with an average of 35 gal. per ton. This is a yield of 211,145 bbl. per acre. Allowing as contingency a 10 per cent loss in mining, a net yield of 190,030 bbl. of oil from the 1,000 acre tract is assured.

The shale-oil consultant and technologist then steps in and states:

A 1,000 ton per day plant on this tract will give a production of 750 bbl. of crude petroleum per day. This crude will cost $1 per barrel or less, to produce, including all overhead. It will sell at $1.75 per barrel, f.o.b. plant. A daily net of $562.50, or $196,875 yearly net, is indicated, which will return 28 per cent on $700,000—the construction and working capitalization of this 1,000-ton installation.

Such a report, based on careful diamond drilling and exact chemical analysis, would provide accurate basis for determining the scale of operations to be undertaken, daily output, life of the property, and the scale of financing necessary.

To one who will take a comprehensive view of our economic and industrial future, it must be evident that radical changes in the fuel situation, full of tremendous opportunity for the engineering profession and of well-nigh inestimable benefit to the race, are in the years just ahead. In every phase of our coal, oil, gas, electricity and fuel conditions changes loom. In coal we see the day of smokeless fuel coming, with a new distribution and utilization of products to be worked out. The products of low-temperature carbonization are different and untried; already their characteristics and market are being explored. In oil shale I see a great, new industry, comparable in every way to the coal-mining industry, taking form. It requires no great stretch of the imagination to comprehend the production of a third of our present petroleum requirements, say 250,000,000 bbl. a year, from oil shale. These 250,000,000 bbl. of shale oil will involve the mining of 350,000,000 to 500,000,000 tons of shale, approximately the annual tonnage, or a little less than the annual tonnage, of our bituminous coal industry. Already the situation has assumed in certain quarters the following rough aspect as to national production and supply: As we go forward into the years following the peak of American well-oil production the California oil fields will long continue to supply the Western or Pacific region of the country; increased importations from Venezuela, Colombia, and the Latin American countries will hold the situation on the Atlantic seaboard; and in the great central regions of the country, from the Rocky Mountains almost to the Alleghanies, the consumption of petroleum and its products will be increasingly met by the production of shale oil.

The project is essentially a manufacturing one in a new and sparsely populated region. We must face the collection of a large labor contingent, the creation of new towns, with their roads, water systems, movies and all the wrinkles of modern town life. If it were not for the great porphyry copper-mining operations, we would have two great types of problem, instead of one. The huge steam-shovel tonnages of the porphyries have already standardized mining operations for oil shale. The working out of the oil-shale industry, with its heavy demands on labor, machinery, and capital, means an economic and industrial development that will equal, if not surpass, the coal, motor, or agricultural industries. It is a challenge to American engineering and bankers.

## Polar Sea Water Comparatively Rich in Gold

At the annual meeting of the Verein Deutscher Chemiker, held at Kiel, Professor F. Haber gave the results of a research which he and Dr. J. Jaenicke had been prosecuting for many years. Earlier investigators found that the gold content of sea water was from 5 to 10 mg. per metric ton, but the above-mentioned research on 5,000 samples collected from many seas and from different depths showed that the amount present is smaller. Water from the South Atlantic contained less than 0.01 mg. per ton; water from the bay of San Francisco a little more, and samples from the Polar seas four or five times this quantity. Melted ice from the Polar seas was often considerably richer in gold.

The form in which gold occurs in sea water is not, as previously supposed, as dissolved aurichloride, but as a mineral slime or as a constituent of the plankton organisms. Its separation is effected quantitatively by adding a minute amount of alkali polysulphide and a trace of copper, and then filtering through fine sand charged with sulphur. This process, however, would not be practicable on an industrial scale.

# Useful Operating Ideas

## A Novel Austrian Electrically Operated Cable Tramway

By Charles J. Webb
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A novel form of cable railroad has recently been completed up the Erzberg, in Styria, Austria, the novelty lying in the fact that whereas usually only one ascending and descending car is employed, in this case there are two ascending and two descending vehicles. The Erzberg, which is worked by the Austrian Alpine Montan Gesellschaft, is, at least so far as its cone-shaped summit is concerned, a mass of ore which is mined by open workings on benches ranging from 32 to 40 ft. in height and extending from 2,460 ft. above sea level to the summit, 5,024 ft. in altitude. Only a small proportion of the workers are housed at the top, and some means were necessary for transporting the large number of employees who live in the valleys, principally in the Trofen Valley, on the northern side of the mountain.

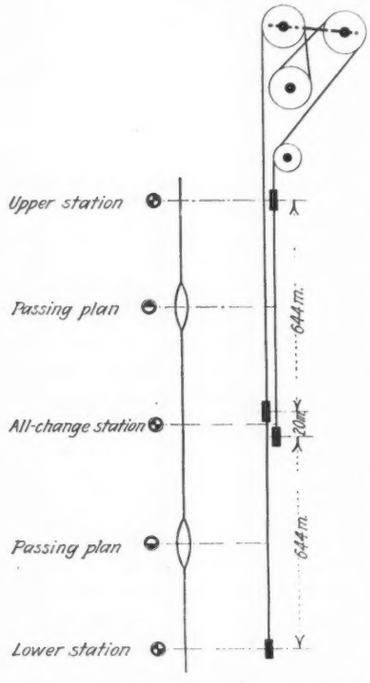


*Diagram showing location of cars on four-vehicle cable railroad*

The problem consisted of conveying 800 men up and down the mountain from 2,420 to 4,008 ft. above the sea, a difference in altitude of 1,588 ft., in the minimum amount of time. It was found that with an ordinary meter-gage cable railroad with one ascending and one descending car it would be possible to convey 450 men per hour, or only about half the desired number. In view of the maximum gradient of 61 per cent, it was not possible to increase with safety the speed or the capacity of the cars. Eventually it was decided to construct a single line with two passing places so that four cars—two ascending and two descending—could be operated, and so convey all of the men up or down in one hour.

Although the whole line is worked from a single power winding station at the top, and all cars are connected up to the same cable, it is practically divided into two sections, each of which has its own passing place. The two cars secured to the lower ends of the cable operate along the bottom section of the line while the upper pair run between the terminals of the top section. In the center of the line is an "all-change" station, where the men having come up in one car meet and change over to the one that has just come down from the summit. The direction of running of the cable is then reversed, the men being conveyed to the top in the second car. The operation can be followed from the sketch. The cars are provided with doors on each side so that the time occupied in changing from one vehicle to another is reduced to the minimum. Provision is also made to prevent collision occurring at the central station in case of accidental overwinding at the summit. Each car is divided into five compartments and has accommodation for 44 sitting and 47 standing passengers, and there is room for eleven more on the end platforms, or a total of 102 per vehicle.

The line has a total length of 0.83 mile or about 1,450 yards. The maximum gradient is 61 per cent, the minimum is 22.2 per cent, and the average for the whole line 39.4 per cent. The upper section is, however, much steeper than the lower one, the respective average gradients being 55.8 and 24.8 per cent. Different diameters of cable are used for the two sections, the upper section having a diameter of about 2 in. and a breaking load of 127 tons; that for the bottom section is about 1.4 in., with a breaking load of 64 tons. The weight per foot is respectively 5.8 and 3.2 lb. The cable guide rollers are set in the center of the meter-gage track, those for the upper section being provided with roller bearings. A system of electro-magnetic brakes is fitted to all the cars, the necessary current, 500 volts d.c., being supplied from a cable alongside the line; this also supplies the current for lighting the cars and the central change-over station. In addition, the cars on the upper sections are equipped with special automatic brakes arranged to grip the rails to meet any emergencies such as the breakage of the cable. As an additional precaution, four instead of two electro-magnetic brakes are also provided on the two upper cars.

The winding gear which is at the summit is of the type known as the Ohnessorge and is electrically operated. Only a relatively small motor is required, as the fully loaded upper cars weigh only 15.2 tons each and those on the lower section but 14.7 tons. The installation was made by the A. E. G. Elektricitats Gesellschaft, of Vienna.

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## Concentration of Solution Values in Evaporating Cyanide Pulp Samples

By G. C. Tyrrell
Engineer, Kirkland Lake Gold Mining Co., Ltd.

On assaying pulp samples, from the cyanide plant, containing high-grade solution some difficulty was found in obtaining concordant results. With similar samples containing low-grade solution no difficulty was experienced. Several pulp samples containing high-grade solution were taken, quartered down, put in enamel-ware dishes, and evaporated to dryness on an electric hot plate. Before evaporation an assay was

made of the solution contained in the sample and the moisture was carefully taken. From these results the gold in the solution part of the sample was calculated. The final dried pulp was assayed and was found to contain less gold than was actually contained in the evaporated solution.

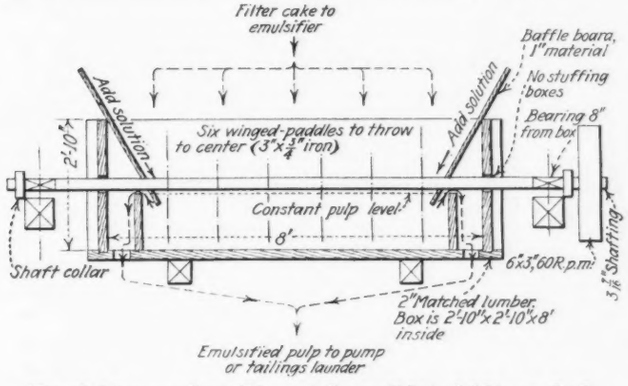
A very thin layer of dried pulp was noticed on the bottom and sides of the dish in which the evaporation took place. This was found to assay more than ten times as much as the original solution. From this one can see that the gold in solution concentrates on the bottom and sides of the dish (where the heat is greatest).

The remedy in use here is to add a small quantity of zinc dust to the pulp before evaporating. In spite of the muddy condition, this is found to reduce a $3 per ton solution to 15c. per ton. The pulp may then be evaporated to dryness with little or no concentration.

## Repulping Box for Handling Filter Cakes

By Robert E. Dye
Timmins, Ontario

When double filtration was adopted at the cyanide plant of the Vipond Consolidated Mines, Ltd., Timmins, Ont., some months ago, it was necessary to devise a




*Emulsifier used at Vipond Consolidated Mines, Ltd., Timmins, Ontario*

ready means for repulping or "emulsifying" the filter cake between stages as well as before pumping it to waste. The accompanying illustration shows the repulper which was built. Two of these are in use, each of which repulps 300 tons, dry weight, of filter cake per twenty-four hours with an equal weight of solution or water, giving a product which is absolutely free from any lumps of filter cake not perfectly pulped. About one horsepower is required for each machine. In the six months of operation since the filter plant was started the machines have given no trouble.

In the design of the machine, the following points were established as essential to the success of the unit: (1) Stuffing boxes were avoided, as these are a constant source of annoyance; (2) a large shaft and heavy paddles were provided to secure rigidity and long life and to eliminate bearing trouble; (3) sufficient volumetric capacity was provided so that an appreciable time would be given to the operation, even though it is continuous, thus reducing the required speed of the revolving parts and at the same time the power and the wear. The machine was designed to meet requirements at the Vipond, but it is felt that the ideas involved could be readily and advantageously adapted to the design of repulpers for the same or similar conditions.

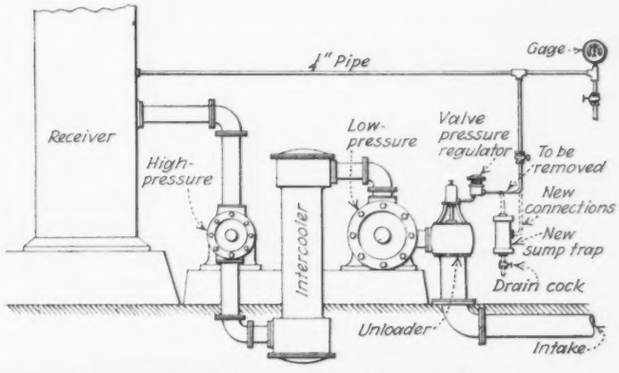
## Overcoming Faulty Operation of Compressor Unloader

By D. Welge
Electrical Engineer, San Francisco

It is a common practice to connect the pressure regulator of a compressor unloader to an overhead pipe. The ¼-in. auxiliary pipe from the receiver to the pressure gage and pressure regulator as shown in the accompanying illustration was the arrangement in use at a mining property. The hot air carries considerable oil vapor and moisture, which condenses in the small pipe and flows by gravity to the pressure regulator, and fouls the delicate moving parts to such an extent as to make it inoperative. When the pressure regulator fails to function, the air pressure in the receiver either rises or drops, depending upon the position of the unloader. If the unloader is held open, owing to this trouble, the air pressure will rise to a point where the safety valve will blow off. This blow-off pressure is set higher than normal working pressure, and therefore more power is taken by the electric motor or engine. It is not only a peak but a sustained peak for the total period of excessive air pressure.

Electric power schedules and power charges are usually based upon maximum demand kilowatt peaks. It therefore pays to give some attention to the pressure regulator of a compressor. If the position of the unloader is held closed, because of a faulty regulator, the air in the receiver will be consumed and the pressure will gradually drop until machine drills in the mine fail to operate efficiently or to operate at all. Thus another expense is involved in labor loss. The aggregate losses will amount to an appreciable figure in the course of a year, which in turn helps to reduce operating profits.

On a small Nevada mining property the compressor attendants found it necessary to dismantle the pressure regulator from two to three times each eight-hour shift. Small quantities of oil, water, and carbonized oil specks would stick the moving parts together so tightly that considerable force was necessary to get them apart for cleaning. This trouble was overcome by installing a trap as shown by dotted lines in the illustration. The trap can be made from standard pipe and fittings—2½-in. diameter pipe by 12 in. long with reducers at top and bottom. It is important to place the trap below the pressure regulator and to open the drain cock once each shift to blow out its contents. This is both quicker and cheaper than having to dismantle the regulator at intervals of three or four hours.




*Drain trap placed between receiver and compressor unloader*

# Discussion

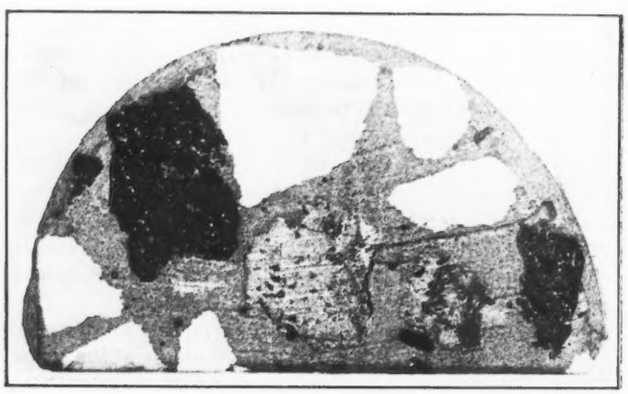
## Angular Fragments in Veins

THE EDITOR:

Sir—Your article in the *Engineering and Mining Journal* of Sept. 25 on "Successive Banding Around Rock Fragments in Veins" has attracted my attention mainly because of your deductions that a "solution must have been able to float the fragments, for they are clearly separated from one another, etc."

My observations made from many hundreds of ore sections lead me to believe that such a conclusion is not warranted and that the appearance of an ore section may be very misleading. A little study will show why we should have a care in making deductions from such observations.

Let us first consider a specimen of vein rock which



*Plane section of contiguous ore fragments in cement*

for purpose of argument is considered to be made up of an aggregate of irregular fragments of rock piled up as they may fall together in a bin. Here we will have coarse and fine fragments and voids intermixed. On this assumption we must admit that each fragment must lie at rest with some points in contact with its neighbor fragments.

Let us now inquire into the mathematical probability that any random plane section made through the specimen will pass through these points of contact. Let us now assume an average number of points in contact for each fragment. Call this $A$. We know this number is clearly finite and not large. Also let us call the number of fragments $B$. This may be a large integer, but clearly it is finite.

It follows therefore the number of points of contact in the specimen may be represented by

$$\frac{A \times B}{2}$$

(The divisor 2 is necessary because each point of contact satisfies two fragments.) This is also a finite quantity. It is also an integer and it may be a large number.

If we now pass a family of parallel planes through this specimen in any chosen direction we shall have an infinite number of planes cutting the specimen. In this family of planes the maximum number of planes which can pass through points of contact are

$$\frac{A \times B}{2}$$

The number of tries is infinity and the probability then becomes

$$\frac{A \times B}{2 \times \infty}$$

which is an infinitesimal.

If we care to enlarge upon this conception and apply the probability to all possible directions, we can first say that the number of possible directions of passing parallel families of planes through the specimen is infinite, and that

$$\sum_{o}^{\infty}\left(\frac{A \times B}{2}\right)$$

will represent the maximum possible number of planes in all space which will pass through points of contact between fragments. This quantity is equal to

$$\infty\left(\frac{A\,B}{2}\right)$$

(An infinite number of families of planes times the number of planes in each family passing through points of contact.)

Now the number of tries is infinity squared because there are an infinite number of planes in each family which cut the specimen with an infinite number of families of planes of directions. The probability then becomes,

$$\frac{\infty\left(\frac{A\,B}{2}\right)}{\infty^2}$$

This is also an infinitesimal of the first order.

Mathematically, therefore, the probability is very strongly against any random section, made through a pile of irregular fragments in contact, showing many actual points of contact between the fragments.

If, therefore, a section of mineral fragments in contact with each other can show but very few points of contact with each other, the sections must appear as if the fragments were suspended or floating.

Experiment also confirms this mathematical generality, and I am forwarding to you a section made from such an experiment. In this test a few ¼-in. holes were drilled in the bottom of a beaker. The beaker was then filled with fragments of broken rock and minerals and these shaken down. The top of the fragments were held down firmly with a weight, so that there could be no motion of the particles of mineral *each in contact with its neighbor*. (See photograph.)

The beaker was then slowly and vertically pushed down into a body of liquid red cement grout so that this grout would rise slowly up vertically, displacing the air and completely surrounding each of the particles. The whole was then allowed to set hard. After setting, sections were made of this "concrete" block, and the section that I am sending you is one of these.

You will note how well the mathematical prediction is verified. The experiment is very simple and is well worth any one's time to do.

You will of course note that this discredits the assumption that "the particles must have been able to float because they are clearly separated from one another" in rock sections and eliminates this argument as a proof of suspended rock fragments. It of course does not prove that fragments may not be suspended.

Denver, Colo. A. J. WEINIG.

## More Anent the Early History of Cyaniding

THE EDITOR:

Sir—The picturesque anecdotal comment of Mr. Charles Butters in your Oct. 16 issue compels a reply.

I stand by all that I wrote, but would add that Mr. Butters is right and timely in his statement that the conflict in South Africa should never have arisen. Indeed, I journeyed thither in 1894, after the introduction of the cyanide process into New Zealand, under special instructions to avoid the lawsuit. I interviewed Messrs. Lionel Phillips and John Hays Hammond with that object; rather than risk a lawsuit they had offered ¼ per cent more than my standard royalty in New Zealand; this offer had not been accepted by the A. G. R. Co. My arrival was too late, and I had to stand aside while the action was fought.

As Mr. Butters and all the world knows, the really decisive action was fought in England, whence the vast majority of the gold output of the world is controlled. There the judgment was entirely in favor of the McArthur-Forrest patentees. But the African mine owners were shrewd enough to foresee the possibility later on of an appeal to the Privy Council and effectively provided for this by an arrangement as to the payment of law costs. Cyanidation was originally introduced for the treatment of refractory ores and concentrates only. The method of agitation of the charges in small cylinders or in Wheeler pans was much too costly for general use. Although the process had been previously introduced into Australia by the McIntyres, into New Zealand by McConnell, and into America by MacArthur himself, there has not been a single real adoption by any mine.

In Africa I decided to modify the process by relying on percolation only. My modification did not have the support of the patentees; the Robinson plant was not erected with their money. One of the first statements made me by Mr. MacArthur on his arrival after the building of the Robinson plant was that he had arranged to have small agitators built in Glasgow sent out to supplement the action of the leaching vats. These cylinders were never needed; the work previously accomplished at the Salisbury battery showed how absolutely we could rely on the efficiency of the leaching vats.

Thus was the cyanide process effectively introduced, available for "tailings" as well as for refractory ores and concentrates, and its world-wide adoption is now a matter of history. My point is that this modification of mine, although it made all the difference between success and failure in the treatment of "tailings," has never in any way been recognized by the mining groups of the Rand who profited so widely from it.

Mr. Butters gives us a vivid story of his haste to race into Johannesburg to impress on the Corner House the desirability of the purchase of the patents. But really the matter had been decided long before. Mr. Hermann Eckstein had shown me, then quite young, such extreme courtesy and kindness in the early days of the preliminary work, that my first step, when convinced of the great local success awaiting us, was to offer him the patents, even though a syndicate formed by my brother was eagerly seeking their purchase. Later on, my brother, whose syndicate succeeded in acquiring the patents, again offered the patents to the Corner House; their reply deserves publication as indicating the high character of the firm. They were unable to acquire any interest in the cyanide patents which might eventually bring them into conflict with the very industry they were building up and protecting. This was in 1890. The Robinson clean-up to which Mr. Butters refers took place in the early part of the following year. It is obvious now why a firm acting on such high principles selected as their advisers men whom Mr. Butters and I delight to honor.

The bond of college confraternity does not compare with that uniting the American engineers who served in South Africa during the early '90s. High motives, sound reasoning, hard work, whole-hearted loyalty, and keenness on improvements in practice: has the inception of any mining field a higher record?

London, England. ALFRED JAMES.

## As an Engineer Sees It

THE EDITOR:

Sir—A communication, "As a Lawyer Sees Mining," in the Dec. 4 issue, prompts me to express some opinions that I have long needed to get off my chest. While I can hardly be classed as a so-called mining scout, I have examined a good many properties in the course of a careful search for something with promise. This took in all classes, from bare prospects to producing mines. Incidentally, there was very little time to stick around a cigar stand, and I had to be contented with rolling one occasionally; so perhaps I do not qualify.

What I want to mention in particular is the large number of properties owned, controlled, or managed by lawyers, doctors, dentists, bankers, cattlemen, butchers, storekeepers, lumbermen, farmers, and in fact anyone but a man with training and experience in mining. The usual result is about what I would expect to get if I went to a plumber for legal advice or paid a blacksmith to put an inlay in an obstreperous molar. Yet people hand over hard earned money to such as these to develop and operate a mine. They bungle along for a period of time, perhaps take out a little ore and finally reach the point where it is difficult to raise more money to equip the property or revamp the unsuitable equipment already purchased. About this time a mining scout, or let us say an ordinary mining engineer who has cut his eye-teeth, comes along and looks over the layout. Perhaps it has some promise, but everything he looks at bristles with glaring mistakes caused by inexperience and over-enthusiasm. When it comes down to a discussion of price and terms he finds that the buyer is expected to pay for all these follies dollar for dollar. The price of the property is based on the amount of money already spent plus a certain sum for ore in sight or believed to be just within reach. Having cut his eye-teeth, the engineer knows the buyer will make a few mistakes himself. It is bad enough to pay for these without taking on somebody else's. So he tells

the owner what he figures the property is worth and that is the end of it. The discrepancy is large and the owner thinks the engineer is a highwayman.

Time and a natural inability to write will not permit of citing numerous instances that come to mind. I have just turned down a man who states he has a million tons in sight. One short tunnel constitutes the underground work, and the purchase price is only about $150,000. Perhaps I have passed up the opportunity of a lifetime, but I hardly think so. Some properties are priced according to probable net profit on estimated ore reserves, but what can a poor "scout" do when his own careful estimate of tonnage and that of the owner do not tally by a wide margin; especially when the probable profit is predicated on a large expenditure in equipment necessary for more economical operation? There are many properties worthy of development from a geological standpoint that are not grabbed up for the same reason that a man doesn't grab up two-cent stamps at five cents each.

As Mr. Russell states, all mines were originally prospects, but many instances can be cited of mines that paid their way from the grass roots. I will not dispute the statement that the percentage of successes in mining far exceeds that of any other line of business, not being familiar with statistics and history in other lines. I would be contented, however, with a fraction of the difference between the total sum expended in mining enterprises and the total proceeds. I believe I could build a pretty good fence to keep the proverbial wolf away from the door. This is not knocking my own profession; I went into it with my eyes open and have not had cause to blink at the facts since. ENGINEER.

Talache, Idaho.

# Consultation

## World's Leading Metal Producers

"Can you tell me the present most productive districts and the most productive individual mines in the world for the principal metals?"

The question of districts is not so difficult to answer as that of individual mines.

**Gold**—The premier gold district is the Witwatersrand, in South Africa. In forty years it has produced gold to the value of about £850,000,000. Current production is around 850,000 oz. per month. The mining company with the largest current output is Government Areas, on the Rand, which reported a gross revenue of £386,150 in October. This was equivalent to approximately 90,000 oz. Second place goes to Crown Mines, also on the Rand, and third to the Hollinger Consolidated Gold Mines, of Porcupine, Ontario.

**Silver**—Pachuca, in Mexico, is the leading silver camp, with the Real del Monte, Santa Gertrudis, and several small companies contributing to the output of perhaps 2,500,000 oz. per month. Real del Monte holds first place among the large producers of the world, with Cerro de Pasco, of Peru, second and Anaconda third.

**Copper**—Butte probably continues to hold first place among copper-producing camps, as it did in 1925, though some increase in rates of output at Bingham, Utah, and at Chuquicamata, in Chile, has been made recently. The order of the largest producing companies probably is Anaconda, Utah Copper, and Chile Copper. The annual figures for the three companies in 1925, in tons, follow: 118,002; 107,085, and 109,758.

**Lead**—Southeast Missouri maintains the lead among lead producing districts, followed either by the Coeur d'Alene district, in Idaho, or the Kootenay district, in British Columbia. The biggest single producer is the St. Joseph Lead Co., of Missouri, followed by the Consolidated Mining & Smelting Co., of British Columbia. This does not take account of the American Smelting & Refining Co., which is a large producer of mine-lead through subsidiaries in the United States, Mexico, and elsewhere.

**Zinc**—The Tri-State district produces about half of the United States output of zinc and is easily the leading zinc-producing area in the world. The Franklin district, in New Jersey, is second in the United States, but Broken Hill, in Australia, has a higher production than New Jersey. The New Jersey Zinc Co. produces more zinc than any other one mining company in the world.

## Detection of Tungsten

"How can I test a mineral to determine whether it contains tungsten?"

The following notes are extracted from Bulletin 121 of the Arizona Bureau of Mines:

1. Tungsten forms in hydrochloric acid a lemon-yellow residue that is soluble in ammonia. To make this test place in a test tube or some other glass or porcelain receptacle a little of the mineral that is to be tested (use about that amount of the powdered mineral that can be held on the tip of a knife blade). Pour into the receptacle about two teaspoonfuls of concentrated hydrochloric (muriatic) acid, and heat to boiling. Boil strongly, replenishing the acid if necessary, until a lemon-yellow colored residue (tungstic acid) has formed in the bottom of the receptacle. If ammonia is added to this solution until the solution smells strongly of ammonia the lemon-yellow colored residue, if it is tungstic acid, will be dissolved.

Beginners practicing this test should use scheelite or some other easily soluble tungsten mineral.

2. Tungsten can usually be detected by the blue oxides of tungsten formed on the addition of tin or zinc to a hydrochloric acid solution.

To make this test: Follow the instruction as given in test (1) up to and including the formation of the lemon-yellow colored residue (tungstic acid) just before the ammonia is added, and then proceed as follows: To the solution containing the tungstic acid add a piece of metallic tin or zinc. (If no pure tin or zinc is available, use a piece of galvanized iron with the zinc on it, or a piece of a tin can with the tin on it). On the addition of the tin or zinc the solution turns deep blue and later changes to brown providing the mineral used in the test contains an appreciable amount of soluble tungsten.

Tests (1) and (2) should be used only on very soluble tungsten minerals such as scheelite, as the test will take too long if used directly on rather insoluble minerals such as wolframite or hübnerite. The rather insoluble minerals should be given the preliminary fusing treatment. The fused mass resulting from the fusion should then be treated as just described in tests (1) and (2) for tungsten.

3. Tungsten can usually be detected by the colors it imparts to the fluxes.

(a) All of the borax beads of tungsten are colorless except the warm, saturated beads, which are yellow.

(b) All of the salt of phosphorus beads of tungsten are colorless except the warm, saturated bead, which is yellow; and the cold, saturated bead, made in the reducing flame, which is greenish-blue.

# News of the Week

## Summary

*SENATOR ODDIE proposes legislation to develop geophysical methods of prospecting—Duprat mineral deposit mapped by electrical survey—Abandoned mines may yield profit.*

*Shannon Copper may increase holdings—Humboldt smelter to close Jan. 1—Bonney mine dewatered—Shattuck sinks Denn shaft to 2,000 level—Recent developments in Michipicoten district, Canada.*

*Garfield smelter breaks previous records—International opens new orebody near Tintic.*

*International Smelting to double capacity of Rico mill—Noranda smelter construction goes forward—Property to be electrified.*

*Copper Range producing 2,000,000 lb. per month—Quincy shows improvement—C. & H. completes power line to Cliff mine.*

*Transvaal gold and diamond production continues at record rate—Rand mines increase profits by looking after small details.*

*Tomboy Gold may close plant—Gold discovery reported near Edwards, Colo.—Gardens a feature at Joplin mines.*

*Gold Areas of Darien region, Panama, worked by Spaniards in 1680, but dormant since 1911.*

*Government power station recommended by Australian Commission as aid to gold mining.*

## Quebec Mining Stocks Register Remarkable Gains, with Noranda in Lead—Mills Increase Capacity

*By Our Special Correspondent for Northern Ontario*

THE mining exchanges these days are registering remarkable gains in some of the Quebec mining stocks and also in the stocks of other companies with Quebec holdings. Things have approached the proportion of a boom and there is a great and growing public interest. Noranda of course has always been the leader, and this stock has kept climbing until it reached $23 a share, a record price, which places a value of about $45,000,000 on the property. Though there is no apparent reason for this movement, many holders of the stock, even those closest to the insiders, are afraid to sell for fear they may not get their stock back, as they believe that eventually it will record much higher prices. It is a reasonable assumption that at some future date ore reserves above the 300-ft. level will amount to $45,000,000, and when it is considered that approximately 60 per cent of the gross value of the ore should be profit, there is substantial ground for faith in the future of the company.

Nipissing Mines, of Cobalt, on its Quebec holdings has risen from $6 a share a month ago to over $9 a share. This represents an increase of $3,600,000, in spite of decreased earnings from the parent properties in Cobalt through the lower silver prices. Good discoveries have been made on the company's Montbray holdings. All payments on the option were recently made and indications point to the property being taken over.

A few days ago Area was 25c. a share; today it is over 60c. a share, on the results of the electrical surveys. The Lundberg method of electrical prospecting has been used on this property, and at least four major indications have been encountered. These are considered to be the most promising indications yet found by electrical prospecting methods in the Rouyn district, except on properties with known orebodies. It cannot of course be said that these electrical indications necessarily point to commercial ore, but in the Noranda-Waite-Montgomery-Amulet section there are no large known bodies of barren sulphides, and so the odds in favor of the Area are considered to be good. These discoveries have been made close to the Amulet line, and in fact some of them pass over the line. If they prove to be important for the Area they are almost bound to be important for the Amulet, and as a consequence Amulet stock has also recorded a jump from $1.35 to $1.80 a share. Further information should be known regarding at least one of these discoveries, within a very short time, as a drill is now being moved on to the ground. If these new indications on the Area and the Amulet justify expectations, a tremendous impetus will be given to electrical prospecting. This method has many supporters, who believe that it offers one of the newest and best aids to prospecting. *E. & M. J.* has often bewailed the disappearance of the old-time prospector, without perhaps realizing that his place is gradually being usurped by a new type of highly trained prospector and also by the scientifically trained men who have at their disposal resources such of which the old-timer never dreamed.

### Wright-Hargreaves to Increase Mill Capacity

The Wright-Hargreaves mine, of Kirkland Lake, is making plans to increase its mill capacity to 600 tons a day, the increase to take place some time early in the new year. The crusher capacity will be doubled in January and a large new hoist will also be ordered the same month. This will permit the opening up of a lot of ground on the main break between the Lake Shore and Sylvanite. The Wright-Hargreaves has a total length along the strike of 3,800 ft., of which less than 2,000 ft. has been really developed. The mill is now handling 400 tons a day, but during the present year the grade was increased to over $15 a ton, so that the output for 1926 will be about $2,250,000, compared with $1,800,000 last year. During the year the company paid 32½ per cent dividends on its capital of $2,750,000, and the regular quarterly dividend of 2½ per cent payable in January has just been declared, together with an extra bonus of 12½ per cent.

Good progress is being made with the construction of the new 200-ton mill at the Sylvanite property, but owing to the delay in the deliveries of equipment, it is hardly expected that the mill will begin operating before spring. It is expected that mill heads will run between $12 and $15. Underground development continues to be favorable, and on the claim adjoining the Wright-Hargreaves 300 ft. of ore has been opened up which will average between $12 and $15 across 5 ft. Diamond drilling on the 1,500 level has also cut an ore intersection showing 6 ft. of $10 grade.

During November the Vipond mill of Porcupine treated 8,104 tons of ore and recovered bullion to the value of $61,000, an average of $7.53 a ton. There were no outstanding developments during the month, but the outlook in the south part of the property, near the boundary of the North-Thompson claim, is stated to be especially good. Development work in this section is being done on the 300 and 400 levels.

La Rose shareholders are being circularized to the effect that arrange-

ments have been completed with a New York banking and brokerage house which will provide funds to carry on its plan of development on both the Cobalt and Rouyn properties. The letter states that arrangements will be made to list the shares in the new company—La Rose-Rouyn Mines., Ltd.,—on exchanges in both New York and Toronto. The company considers the Cobalt properties still capable of a substantial production and states that on the Rouyn holdings the work has indicated an orebody carrying up to 6 per cent copper.

In November the Keeley mine, of South Lorrain, produced 125,097 oz. of silver and 14,967 lb. of cobalt. During the month silver was found in the right branch of the Woods vein, on sublevel No. 2, and it is considered probable that ore in paying quantities will be found in this section.

A new company known as the Bathurst Mines, Ltd., with a capital of $2,000,000 shares, has been incorporated to take over the nine Bathurst claims at Narrow Lake, northwest of the Red Lake section. Some of the names on the directorate are Irving W. Bonbright, of New York; J. Y. Murdoch, president of the Noranda Mines; T. H. Rea and Orlando P. Willcox.

#### Recent Development in Michipicoten District

It is understood that plans are being drawn for a mill for the Cooper gold mines, in the Michipicoten district. This property is owned by the Pioneer Mining Corporation, which is an exploration company. On the Cooper a 500-ft. oreshoot has been opened up which gives an average of approximately $12 across 5 ft. A new main shaft is now being sunk. On an adjoining property another vein has been opened on the surface for a length of 175 ft. and gives $12 across 8 to 10 ft.

At the old Grace mine, in the Michipicoten district, an electric power plant has been installed, a shaft has been dewatered and retimbered and a new headframe erected, as a preliminary to continuing the shaft to a depth of 500 ft. A new compressor and drills have also been purchased, and it is expected that a considerable amount of development work will be done.

## Duprat Mines Prospected by an Electrical Survey

Work started on Dec. 14 on the Duprat mines, in the Rouyn area of Quebec, in connection with the survey being conducted by H. Lundberg, of the Swedish Electrical Co., whose operations on the Amulet and Area mines have been attended with marked success. An area, highly mineralized, about 500 ft. long and 150 ft. wide has been found on Duprat; and the survey now started is for the purpose of locating the center of concentrated values. Once this can be determined a diamond drill will be used to draw the core from the richer section. Test pits to a depth of 20 ft. have shown the ore as massive and analyzing high in copper. As there is a considerable section where the overburden prevents trenching, it was considered best to make the electrical survey before selecting the location for a central development shaft.

## New Lead-Ore Shipper in Victoria County, Ontario

Lead mining in Ontario is steadily increasing, and another mine will soon be added to the list of producers. The Summerville Lead Mines, Ltd., is operating a property in Summerville Township, Victoria County, Ontario. Preliminary work in an open cut has disclosed good ore in a fissure which varies from 4 to 8 ft. in width, and has been traced for about 2,000 ft. It carries from 4 to 6 in. of solid galena ore, with some sulphide occurring across the full width of the fissure. The formation is limestone.

Camp buildings have been erected, and the installation of a mining plant is proceeding. It is intended that high-grade ore will be shipped during the early stages of development, there being a considerable amount which can be sorted and shipped at a grade of 25 to 40 per cent lead.

## British America Nickel Plant to Be Operated

Considerable interest has been aroused by the announcement that the big plant of the British America Nickel Corporation at Deschenes, Quebec, which has lain idle since the war, is to be opened again in the near future. The plant has been purchased by McCallum, Smith & Co., Ltd., of Montreal, and there is talk of it being used in connection with the refining of copper from the Rouyn district.

The McCallum, Smith company, which operates the Economy Railway Appliance Co., Ltd., of Montreal, has also purchased the smelter and mine plant of the defunct company at Nickelton, Ontario, and steps will soon be taken to put the machinery at the two plants into operation as speedily as possible. The capital of the new company will be all Canadian, and the control of the plants will be entirely Canadian.

## Garfield Breaks Previous Records

All past records were broken at the Garfield (Utah) plant of the American Smelting & Refining Co. during November. A total of 30,000,000 lb. of copper was produced, which is the largest production recorded during one month. This volume of output is at the rate of 50 per cent more than the total Utah production for 1925. The major part of the Garfield smelter's production was derived from the Magna and Arthur concentrating plants of the Utah Copper Co.

## Manitoba Mining Shows Progress

The Manitoba Industrial Development Board has prepared a report on the mining operations of the present season in Manitoba, in which it is stated that in the Central Manitoba field developments have reached the stage on Kitchener property where the installation of a 150-ton mill is being planned for the winter, and where the underground work has opened up a body of ore which would appear to justify an extensive program for the future.

In the northern field, work has been pushed ahead very rapidly at the Flin Flon to test out the separation process on the mixed ore, and a 25-ton experimental flotation plant will be ready to operate early in 1927. At Cold Lake, on the Sherritt property, the diamond drill has shown an important zinc-copper deposit. New lithium-bearing pegmagtites have been found in the area northeast and east of Lac du Bonnet. The building-stone industry has been considerably stimulated by increased building operations; and progress has taken place toward a local supply of tapestry brick, which is important for the province. There is no increase in production in metalliferous minerals, but when the statistics are made up there will probably be found to be a considerable increase in production in non-metallics.

## Promising Mine Northeast of Joplin

What promises to be a good mine has been recently opened up in the old Joplin field, by the B. & N. Mining Co. It is located on the Buchanan land, northeast of Joplin, Mo., about three miles and near the old Dividend mine, which was a producer about fifteen years ago.

Drilling has been under way on the property for about a year, and shaft sinking was started only a few months ago. Two shafts are now in ore, which is better than the drill cuttings had indicated. Drilling showed a face almost 100 ft. in height, which likely means the sheet ground formation in the original Oronogo-Duenweg "ten o'clock" run.

Harry Neff, of Joplin, is manager of the company, and others in it are Carl M. Berren, of El Dorado, Kan., and Harry Berren, of Parkersburg, W. Va.

## International Opens New Orebody Near Tintic

Forty feet of ore assaying 6 per cent lead, one-tenth of an ounce in gold, and 5 oz. in silver to the ton has been cut by the drift of the International Smelting Co. from the 700 level of the Tintic Standard No. 2 shaft at Eureka, Utah. Although the vein is in Eureka Lilly ground, owned by the Chief Consolidated, about 200 ft. distant, the discovery is believed to have an important bearing on the geological theories under which the International Smelting Co. has undertaken prospecting of its North Lilly group lying north and west of the Eureka Lilly.

## Eagle Lead to Develop Wilcox Mine

Based upon the survey and report just completed by J. H. Williams, geologist, and C. B. Morgan, mining engineer, a preliminary expenditure of $50,000 is to be made upon the property of the Eagle Lead Co., Hatchita, N. M. This property was formerly known as the Mike Wilcox lead mine. A complete equipment of new machinery is to be installed at once, and headquarters will be maintained in this city. J. B. Murphy is vice-president and R. E. Plumbe a director.

## C. & A. Acquires Cobra Negra Property

The Calumet & Arizona Mining Co. has completed details for enlarging the holdings of the 85 Mine, Lordsburg, N. M. The addition will be the Cobra Negra property, consisting of four patented claims, about 70 acres in extent. This ground has been owned for many years by the Susquehanna Mining Co. It covers the direct southwestern strike of the Superior vein, the most productive of the 85 veins, and is close to the northern end of the Bonney mine.

## Bonney Mine Being Dewatered

Unwatering operations are proceeding satisfactorily at the Bonney mine, Lordsburg, N. M. A thousand-foot lead pipe has been laid from shaft No. 2 to carry the water across the outcrops of several veins that cross the drainage. Messrs. Walter Douglas, Gerald Sherman, and E. M. Sawyer, officials of the Phelps Dodge Corporation, made an inspection of the property recently. It is expected that sampling of the lower levels will begin about the first of the new year.

## French Group Buys Control of Swansea Mine

Through the efforts of C. M. Souden, chairman of the board of directors of the United States National Bank of Los Angeles, an arrangement has been consummated whereby a group of French capitalists have taken over the Dutch interests at Swansea, Yuma County, Ariz. The Dutch company was known as the Swansea Consolidated Gold & Copper Mining Co., but the new concern will be the Clara-Swansea Mining Co. Ernest C. Lane, mining engineer, has been retained as general manager of the property.

## Delano Mines Leaching Ore in Place

Leaching in place is being carried on at the Delano copper mine, by the Nevada Bellevue Mining Co., Contact, Nev. Water is pumped from the river to the apex of the vein, where sulphuric acid is added. This solution percolates through broken ore and vein material several hundred feet to the lower tunnel level, where the water is collected and conveyed by wooden pipe to twelve large wooden vats situated at the portal. These tanks are filled with scrap iron and agitated by air.

## Shannon Copper May Take Over Mosqueteros Holdings

Shareholders of the Mosqueteros Mining Co. of Chihuahua, Mexico, have recently been advised that negotiations are pending between the Shannon Copper Co. and the Nathan L. Amster interests, of Boston, to take over and operate the holdings of the Mosqueteros Mining Co. upon a much larger scale than at present. Mosqueteros is reported to have developed a large tonnage of high-grade lead and silver ore, and is making regular shipments to the A. S. & R. smelter at El Paso.

## Gardens at Joplin Mines

A movement for beautifying the premises of mining properties in the Joplin-Miami district was undertaken about a year ago, being instigated by Ott Shaner, of the Central Foundry Co., of Joplin. It was decided to offer prizes for the best flower garden planted at any mill in the field. Prizes were recently awarded, as follows:

Frank Patrum, of the Blue Goose mine of the Commerce Mining & Royalty Co., won the first prize of $25; Ben Shields, of the Oklahoma Woodchuck, won second prize, $15; Eltynne Brigg, of the Cortez-King Brand Mines Corporation, won third prize, $10; Luther Shelton and Charles Gallup, of the Beck mine, got fourth prize; W. L. Long, of the Blue Mound, fifth; and Claude Holden, of the Jay Bird, fifth. The last three prizes were $5 each.

*Flower garden at office of the Blue Goose mine*

## Sinking of Denn Shaft Progressing

Progress in the sinking of the Denn shaft of the Shattuck-Denn Mining Corporation, despite heavy ground which renders the process difficult, is reported by officials of the company. Work on the sinking of the shaft was started less than three weeks ago.

The company plans to deepen the Denn shaft from the 1,838 level to 2,000 ft., but may do some drifting off the 1,900 level before continuing with the sinking. Ore shoots on the 1,800 level are especially encouraging and indicate that ore of the same quality and quantity may be found when drifts are opened up on the 1,900 level.

## Humboldt Smelter Will Close

The low price of silver and copper and lack of production by smaller mining companies is given as the reason for the announced shutdown of the Southwest Metals Co.'s smelter at Humboldt, Ariz., on Jan. 1, 1927, according to an announcement made by G. M. Colvocoresses, general manager. Should the market recover sufficiently to warrant it, the smelter will be reopened in the spring, but will operate on a smaller tonnage, which will have to be assured. Little development work will be done on the company's Blue Bell mine after the first of next year.

## Lead-Zinc Ore Discovered in Red Top Mine

One of the most important strikes in the history of Stevens County in Washington is reported by J. Richard Brown, manager of the Red Top mine, three miles from the Gladstone, in the Boundary district. The ore is silver-lead-zinc. Good ore has a width of 11 ft. and a lower-grade material of 10 ft. The strike was made in the main tunnel 800 ft. from the portal and at a depth of 265 ft. from the outcrop.

## Little Hatchet Sinks Shaft

The Little Hatchet Mining Co., operating 15 miles west of Hatchita, N. M., is pushing development work on the Wyoming claim, where a two-compartment shaft is being sunk. This work is upon an ore zone, showing copper sulphide, that is traceable for nearly a mile and shows a width of from 50 to 150 ft. Development on the Daddy Long Legs claims, owned by the same company, has shown some high-grade silver ores. These will be further opened just as soon as the Wyoming work is well in hand. In the Santa Maria tunnel, crosscut No. 51 is still in good ore. The Little Hatchet company ownes six groups of claims, about 600 acres in extent. Albert F. Bader is general manager.

## Gold Discovery Reported Near Edwards, Colo.

Robert F. Smith, Kremmling, Colo., has discovered near Edwards, Colo., gold-bearing gravel beds covered with two feet of rich black soil. It is planned to install placer mining machinery. The find by Mr. Smith is reported to be the result of a discovery in 1877 which had been reported but forgotten about by all save Smith.

The Lake Creek Placer Mining Co., with offices at Glenwood Springs, Colo., has been organized to handle the property. F. N. Clarke, of Idaho Springs, Colo., has opened an abandoned lode mine near Idaho Springs and is making shipments of sylvanite to the Golden Cycle mill at Colorado Springs. The owner is planning a shaft and a lower tunnel, and will install a mill as soon as possible.

# Washington Letter

By Paul Wooton

*Special Correspondent*

## Senator Oddie Proposes Legislation Authorizing $25,000 per Year to Develop Methods of Prospecting

More definite information as to the practicability and usefulness of the various geophysical methods of prospecting is needed badly by the mining industry, Chairman Oddie of the Senate Mines and Mining Committee is convinced. To provide for this study, the Nevada Senator will propose legislation authorizing a five-year program of work on which $25,000 annually would be expended.

Now that practically all the surface prospecting has been done, Senator Oddie points out that the demand is for some reliable method of subsurface prospecting which will indicate the presence of mineral deposits hidden by overlying material. The capacity of rocks and mineral deposits to transmit, refract or reflect certain forms of energy has led to the development of various devices based on gravitational, magnetic, seismic, electrical, radioactive, geothermal and other phenomena which are said to indicate the presence of mineral bodies.

Some commercial application is being made of these devices, but most of the work which has been done is that of those concerned with promotion of a particular device. A study should be begun by the government, Senator Oddie declares, so that more may be known of the fundamental principles underlying these methods.

Senator Oddie will also seek an addition to the appropriations available for studies of the marketing, transportation, and accounting problems of the mining industry.

## Tomboy Gold May Close Plant

Charles N. Bell, of the Metals Exploration Co., Denver, Colo., recently inspected the Black Bear mine, in Ingram basin. This is said to be a preliminary move by the Black Bear company to purchase the Tomboy mill, which seems particularly feasible in view of the fact that N. S. Kelsey, general manager for the Tomboy Gold Mines, Ltd., has posted notice at the Telluride property that it may close soon.

## Some Abandoned Mines Yield Profit When Properly Handled

Fortunes from abandoned mines are not unprecedented, but it is not often that one company has a record of repeated successes with such properties showing profits of more than a million dollars, which is what has come about for the S. R. & W. Mining Co., in the Joplin-Miami zinc and lead district.

The company was organized four years ago and included Homer Seals, of Miami, a former Joplin operator; Joe and Will Walker, representatives of the Edgar Zinc Co., at Joplin; and J. W. Roberts, present Mayor of Miami, Okla. Each put up $200 and took over the Big Chief mine, north of Picher, Okla. The mine was on a paying basis almost immediately, and the partners were not called upon to put up any more money. At the time the mill burned, early in 1926, it was reliably reported the company had made better than $200,000 in profits. While they were rebuilding the mill they sold the mine to the American Zinc, Lead & Smelting Co. for $127,000.

In 1924 the company took over the Hartford-Good Eagle mine, in the lower Oklahoma field. It had been unprofitable up to that time, but the S. R. & W. soon put it on paying basis and sold it to the Barnsdall Zinc Co. in June, 1926, for $200,000. The latter part of 1924 the S. R. & W. took over the Hartley mine, which had been abandoned by the American Metal Co. S. R. & W. paid $30,000 for it, developed it, and about the middle of 1925 sold it to the Hutcheon Management Corporation for $300,000. In July this year the S. R. & W. took over the Farmington mine, which had been operated by the Federal M. & S. Co., and recently sold it to J. R. Cole, Jr., of Tulsa, Okla., for $200,000.

## Noranda Smelter Construction Making Progress

Work on the erection of the smelter at the Noranda Mines, in the Rouyn area of Quebec, is making rapid progress. It is stated that the directors have decided to ship some of the ore to a smelter without waiting the construction of its own plant. The Noranda has awarded a contract to the English Electric Co. of Canada, Montreal, for the electrical equipment required for the complete electrification of its property.

## Jumbo Mine Under Option

San Diego men have taken over the Jumbo mine, in the Buffalo Hump district, central Idaho, on a bond and lease for $25,000, according to J. C. Jensen, of Lewiston, Idaho, president of the Jumbo Mining & Milling Co.

## International Smelting to Double Capacity

The International Smelting Co. mill, Rico, Colo., with a capacity of 280 tons of ore daily, will double its capacity early next spring. It is stimulating activities among small operators throughout the district by the purchase of ore in small quantities. Excess freight rates on anything less than a carload heretofore have prevented many small mines from operating.

## Storage Battery Eliminates Horse Haulage

The Park Bingham Mines Co., Bingham, Utah, recently installed a five-ton Mancha storage-battery electric locomotive. By eliminating haulage by horses the company expects to expedite exploitation of its eleven faces of ore and to cut transportation costs over the two-mile haul through Butterfield tunnel.

## Copper Range Production Near 2,000,000 Lb. Per Month

Production of the Copper Range company's three mines in the Michigan district is running a little under 2,000,000 lb. of refined copper per month. Output in November was 1,915,000 lb., of which amount Champion produced 1,500,000, Baltic, 225,000, and Trimountain, 190,000. Compared with 1925, Champion is producing its normal amount; Baltic shows a falling off, and Trimountain's production is more than twice as much. On its present basis, Trimountain is making a small profit. The labor situation at all three properties is satisfactory, having considerably improved in the last few months.

## Quincy Shows Improvement

The physical condition of the Quincy mine, Hancock, Mich., has been improved by enrichment of the East lode at depth. The East lode is auxiliary to the main vein, which has been consistently mineralized from grass roots to the bottom of the mine, where values in heavy stamp rock and mass copper persist. The East lode was found to be strongly mineralized at the 86th level of No. 2 shaft. It is more than twice the width of the Main lode and richer. Developments continue most encouraging in this vein. Quincy's yield of refined copper per ton of rock treated is the best in its history.

## Mines Active in Kingman District

Mining activity in the vicinity of the Katherine mine, near Kingman, Ariz., continues to increase. At the Katherine East End property the shaft is to be deepened from the 200 level to the 300. The mine has recently been equipped with a new 30-hp. compressor and a 25-hp. hoist. Other machinery is being installed and new camp buildings are being erected. At the Katherine Extension the shaft has reached a depth of 355 ft. and is said to be entirely in ore. Both of the last-named properties lie east of the Katherine mine. The shaft of the Katherine Treasure Vault has reached a depth of 250 ft. Drifting will be started along the Treasure Vault vein toward its intersection with the main Katherine vein. At the Katherine mine the main shaft is being deepened from the 400 level to the 800. Diamond-drill exploration indicates that the ore extends to a depth of at least 900 ft. The mill is now treating 225 tons per day from stopes above the 400 level, and it is expected that the capacity will be increased to 500 tons when production from the lower levels begin.

## Calumet & Hecla Completes Power Line

Calumet & Hecla has completed the power line from the Ahmeek mine to the Avery shaft of the old Cliff mine, in Keweenaw County, Mich., which will be used as a base for extensive exploratory operations in Keweenaw lands. Five hundred tons of coal have been transported to the property. Good progress is being made on the installation of the power plant.

# Gold Areas of the Province of Panama

## Mines Worked by Spaniards as Early as 1680—Dormant Since 1911—Labor Plentiful

By Captain J. F. Sheridan
16 West 94th St., New York, N. Y.

The Province of Panama is in the eastern part of the Republic of Panama adjoining Colombia. Its population is approximately 100,000. The principal city is Panama, the capital of the republic, with 60,000 inhabitants. The largest river is the Tuyra (Devil) River, which is over five miles wide at the mouth and is ten to fifteen fathoms deep. Tuyra River, in conjunction with the navigable Chuquenaki, Sambu, and the Savannah Rivers, carries off all the waters of the western slope of the Serrania del Darien Mountains and the northern slope of the Serrania del Sapo.

Darien is one of the principal subdivisions of the Province of Panama, analogous to a county. Las Palma, the capital of Darien, has a population of over 1,000. It is the seat of the local government and the home of the governor of Darien. The United States Government some time ago purchased Independence Island, two miles south and west of Las Palma, on which it erected and operates a wireless station.

The town of Chepigana is on the Tuyra, 20 miles above Las Palma, with about 600 inhabitants. The principal houses and pavement (boardwalk) are all built of mahogany. The next town on the Tuyra is Real de Santa Maria, 33 miles up-stream from Chepigana. This is the seat of local government for the district of Pinogana. It is the most important town upriver, and has over 1,000 inhabitants (mostly black). Local legend and history state that William Patterson, the founder of the Bank of England, sent 1,000 men and women to the original Santa Maria, only a short distance from the present site, and that they built and operated the mining camp known as "Troncossa" near the present town.

Twelve miles up the Tuyra River from Santa Maria is Pinogana. It has a population of 400 and was formerly important as a trading outpost when the Cana mines were operating—up to 1911. The village of Yape is on the Tuyra at the mouth of Rio Yape. From here 5 miles of narrow-gage railroad has been built eastward to the site where plans are being completed to drill for oil. The village of Boca de Cupe is the river terminal of a 30-mile narrow-gage railroad of the Darien Gold Mining Co., to the Cana mine. This railroad has not been operated since 1911. The village has a population of about 200. The most important town on the left bank of the Tuyra River is Santa Cruz de Cana, seat of the Darien Gold company's operation. There are about 175 houses for employees and the remains of much mining equipment. At present the mines are idle.

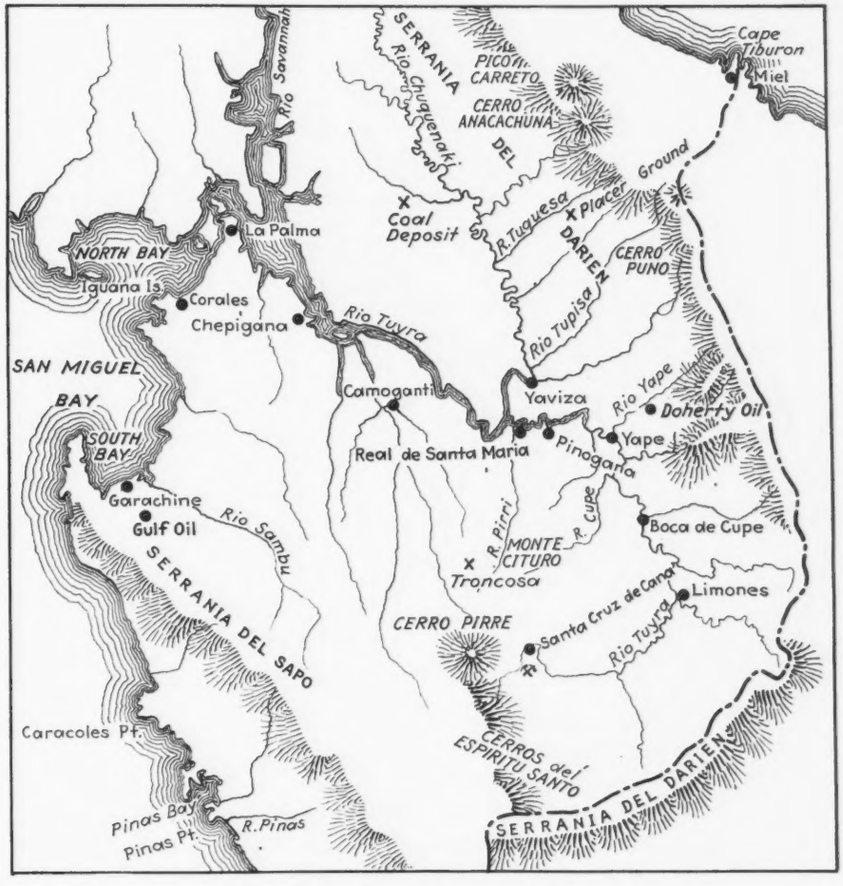
### Gold in Pinogana District

A group of gold placer claims, covering an area of approximately 60,000 acres, of which 20,000 acres have been prospected, is located in the District of Pinogana. The properties lie along the Tuquesa River and its branches. The Tuquesa River flows into the Chuquenaki, which in turn empties into the Tuyra River. Both of these last-named rivers are navigable for seagoing craft as far inland as the town of Yaviza, which is about 25 kilometers from this group of claims. Yaviza, the outfitting point, is approximately 100 miles by water from Panama City.

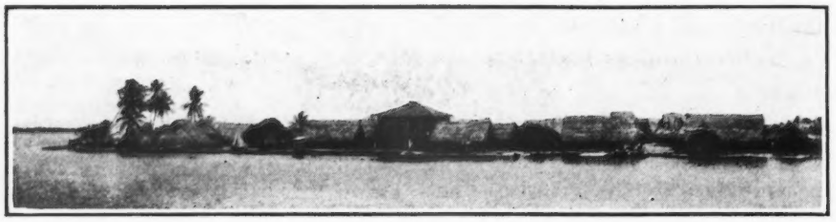
The general topography of the Pinogana district is a succession of valleys lying between short steep ridges of slight elevation. These valleys and ridges form a succession of benches, ascending gradually from the Pacific Ocean to the Serrania del Darien Mountains, separating Panama from Colombia. The region as a whole resembles a broken bowl, encircled by mountains on the north, east, and south, with an opening to the ocean on the west. Throughout these mountains are ores containing free gold, and 90 per cent of the rivers carry coarse, fine, flake, and flour gold. The hardpan and pay gravel occur in benches along the Tuquesa River, half a mile or more in width and from two to three miles in length. These benches show a general average thickness of alluvial deposits ranging from 10 to 45 ft. to bedrock. They carry 72c. to 98c. gold per cubic yard. The total area prospected by drilling and panning paralleling the east bank of the Tuquesa River embraces 20,000 acres and contains approximately 183,750,000 cubic yards of commercial alluvial deposit. One old working on the two upper benches has shown a general average of 90c. per cubic yard while many locations, such as river and creek beds, bars, and pockets, will average over $1 per cubic yard.

The dredging deposits of Pinogana and Chepigana consist of sand and gravel averaging about 25 ft. to bedrock. The upper benches and blankets of these alluvial deposits could be worked economically by the hydraulic method, as there is water in abundance. Where gravel deposits extend several feet below the permanent water level of the gold-bearing rivers there is no accurate method for determining their gold contents. Drilling, which under ordinary conditions is the most accurate, gives only approximate results.

In the vicinity of Pinogana, where the placer properties are located, the backbone of the mountains is made up of andesite or trachyte. Near Chepigana, the tops and sides of the hills are covered with a reddish soil mixed with gravel, and known to the Indians as cascahal. This deposit is from one to thirty feet thick and under this cover lay the schists. The red soil and gravel are gold-bearing and are amenable to panning, sluicing, or rocking. Without doubt a considerable quantity of gold is




*Map showing Darien region of Panama*



*Village of Real del Santa Maria*

supplied from the various quebrados (creeks) that crosscut the auriferous veins.

### Gold-Bearing Quartz Lodes

Quartz veins occur in the Serrania del Darien above the gravel beds. One vein on the Marvaganti River, a tributary of the Tuquesa River, extends north and south and is nearly vertical. Another strikes northeast and southwest. Some development has been done on this vein. It is called the Mother Lode and is from 4 ft. to 6 ft. wide at or near the surface. The vein being almost vertical, of hard, good-standing rock, and the foot and hanging walls being also very hard, the cost of mining this ore should be low, as the conditions are ideal for stoping. There are over two miles of the Mother Lode vein exposed. In a ravine the vein has a width of from 12 to 18 ft., and assays relatively high in gold, with some silver. Some of the small stringers between the veins have shown good working values. The remains of old Spanish workings are found in abundance, but under their crude methods they only scratched the surface by panning, sluicing and crude rockers, or bench methods. Gold amounting to $25,000,000 (?) was declared for taxes in 1802 to 1804, showing conclusively that this region was very rich during the Spanish régime. This represented about *75 per cent of the declared value* of the gold extracted from this region. The Tuquesa River and its tributaries, the Madranti, Maparganti, and Maraganti, have been recognized for centuries by the Indians as the best gold carriers in eastern Panama.

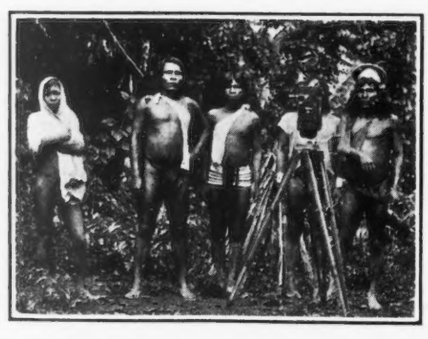
### History of the Cana Mines

All the historical data that are valuable from a gold-producing standpoint during the early and later periods of Spanish occupation of Colombia relate to Espiritu Santo, La Estrella, and Cana gold mines, in the Darien region of Panama, around all of which gold quartz and gold placer properties are grouped. The South or Espiritu Santo Mine is located at the town of Cana, on a plateau about 2,000 ft. above sea level and 40 miles south of Real del Santa Maria. It was first worked about 1680, and was known in 1684 as the "richest gold mine yet found in America." The pirates, under Morgan and other captains, captured the mine at various times—1684, 1702, 1712, and 1724—taking the bullion and working the property to the best of their ability. In 1727 an uprising of the aborigines occurred. This, in connection with a caving-in of the mine, so discouraged the owners that they never returned from Panama City and Cartagena, where they had fled on being attacked by the Indians.

The production of bullion, as reported in a document by Don Andres de Ariza, during the years the mine was worked, amounted to thirty millions of dollars. The greatest depth attained was only 250 ft. Records are reported to show that in one year this mine paid the Spanish Government $284,000 in taxes, which makes the total yearly output $873,000. There is, therefore, little doubt the old Spaniards took many millions from the property.

In 1853 a road was opened to Cana from Santa Maria and some exploration work was done by a French company, but without results, and work ceased for lack of funds. In 1880 another attempt was made to discover the famous mine by a Mr. Wells, but his capital was exhausted in road making, erecting a saw mill, and other preliminaries, with apparently no serious attempt at prospecting. In 1887 the mine was taken over by the Darien Gold Mining Co., Ltd. Nearly nine years were spent by this company in organizing, prospecting and milling low-grade ores from the North mine before the Espiritu Santo mine was accidentally discovered by a prospect winze breaking into the old workings. It was not until 1899 that the mine was sufficiently developed to make large bullion shipments; in that year the value of the bullion exported amounted to $550,000, at a cost of about $150,000. In spite of much interruption in milling due to caving of shafts and stopes and to other causes, the bullion produced from 1899 to 1903 inclusive amounted to nearly $2,500,000, and the depth reached was about 500 ft.

Because of the caving of the stopes a large amount of ore still remained above the fifth level; so much so that over $500,000 was afterwards recovered by milling this mixture of ore and waste rock. The orebody is a prismatic chimney with a horizontal area of about 100x100 ft. and inclined about 18 deg. from the vertical. It is formed at the intersection of two fractures. The history of the mine from 1903 to 1911, when the mine was permanently closed, due to caving-in of the working shaft, is simply a story of the incompetent management. Little or no prospecting in depth was done, other than sinking an inclined shaft 800 ft. to cut the ore at 1,500 ft. No attempt was made to crosscut the ore at the 800 level, the tunnel or drift reaching the footwall only. The pump broke down, the mine was flooded to the 300 level, and for some unknown reason has not been unwatered, although the total seepage did not exceed fifty cubic feet per minute.



*Group of Sambu Indians*

### Health, Climate, and Rainfall

The climatic conditions on all the Darien placer and lode properties are far superior to those of river basins in Colombia. During the last fifteen years I have employed many natives, Indians, and white foreigners on my mining properties. None of these men were ever ill while with me. The blackwater fever is prevalent on the Condoto and San Juan Rivers, in Colombia. The average yearly rainfall for the last ten years is about 100 in. Panama's rainy season starts about June 15 and ends about Dec. 15. The dry season, or summer, from that time to June 15. Average temperature for the wet season, or winter, is about 75 deg.; summer, or dry season, about 85 deg. The higher-altitude properties on the Tuquesa River have about a yearly average of 75 deg. Nights and early mornings are cool. One can sleep comfortably with a light blanket during the rainy season. Work can be carried on through both seasons.

Laborers for unskilled work are plentiful and are fairly good, consisting of West Indian negroes and Negro-Colombia Indian mixtures, at from 5c. to 7½c. per hour, depending on location. The skilled labor necessary to install and operate machinery can now be obtained in Panama City and Colon.

### Transportation by Water

All of the quartz and placer gold properties can be reached from Panama City by gasoline or oil-burning boats, to the Gulf of San Miguel, and then up the Tuyra River to Real de Santa Maria and Yaviza. The U. S. Gunboat "Yorktown" made the trip as outlined above, and anchored off Yaviza for some time, landing 250 marines, during a rebellion against Colombia in 1903. From the Tuyra and Chuquenaki Rivers and tributaries all lode and alluvial properties can be reached by shallow-draft boats and short trails from the river.

The government of Panama is stable, and as the country owes its existence as an independent republic to the United States, citizens of the United States are welcome. The presence of American troops throughout the Canal Zone has had a deterrent effect upon the revolutionary aspirations so prevalent in Latin American countries.

## West Gold Making Regular Shipments

The Jewelry Shop mine of the West Gold Mining Co., Durango, Colo., has installed new machinery and is shipping fifty tons of ore daily to the Golden Cycle mill, at Colorado Springs. Belief that larger veins of rich sylvanite will be opened at the mine are expressed by the management.

# London Letter

**By W. A. Doman**

*Special Correspondent*

## Rand Mines Scrutinize Details and Increase Operating Profit

**London, Dec. 7**—Attention to detail in the mines of the Rand has made a substantial difference in the outlook for various companies. At the recent meeting of the Consolidated Gold Fields, and in the report of the directors of the Van Ryn Gold, mention is made of improved technical efficiency and of details that, small in themselves, in the aggregate make the position better. In the Van Ryn Gold report it is stated that reclamation is still going on, and that last year no less than 211,000 tons, or nearly 35 per cent of the ore mined, was sent for treatment. It is presumably due to this reclamation ore that the company is able to make a substantial profit on the average value of the ore reserves. At June 30 last the reserves were estimated at 1,298,191 tons of an average value of 4.6 dwt. over 47 in. This is less in value than at the end of 1925, the upper leaders on which development work was concentrated being of slightly lower gold content. As regards sand filling, no less than 198,694 tons of sands were lowered into the mine and used as a support where timbering was impracticable.

The motto *Semper aliquid novi ex Africa* has received another illustration in the report from Sierra Leone of the discovery of a substantial deposit of exceptional high-grade hematite in the Port Lokko district about 20 miles from the port itself. The government is to leave its exploitation to private enterprise.

The report of Dome Mining (Spain) for the twelve months ended Dec. 31, 1925, is a disappointing document. It states that the boiler of the dredge has been repaired and that an early resumption of dredging on the present site will take place to give the ground another trial. Further investigations are being carried out, but the excitement created when the dredge was started seems to have died down.

The Mawchi company (Southern Shan States) reports that only about six weeks of actual running is represented in the accounts, owing to reconditioning of the plant at the mine and making necessary alterations.

Once again the failure of the suction cutter dredge is reported. The Kepong Dredging Co. (Malaya) installed one of these dredges, but has had to discontinue its use, and has arranged for a new bucket dredge, the manufacture of materials for which has been delayed by the British coal strike.

At the Pahang Consolidated meeting the suggestion was made that the company's production of tin should be sold forward. The chairman pointed out that as the company used black tin, it was not possible to sell forward, the usual procedure being to dispose of the production to local smelting companies.

A cablegram from Rhodesia announces a strike of gold-bearing ore showing 5 oz. to the ton at Que-Que. This is the district in which the famous Globe & Phoenix mine is situate. The London office of the company has had no direct information; neither has the board of the Rhodesia Exploration Co., although it is thought in some quarters that the pegging in progress must be on the ground of the last-named company.

# Melbourne Letter

**By Peter G. Tait**

*Special Correspondent*

## Government Power Station Recommended by Commission

The committee appointed by the Western Australian Government to report on the government's proposal to assist the mines on the Golden Mile, Kalgoorlie, by co-operating in the provision of cheaper energy from a central power plant, has come to the conclusion that the only practicable means of establishing a satisfactory power station is for the government to install and operate it. The committee recommends that such a power station should be designed for (1) the use of pulverized fuels, (2) the use of steam-driven turbo generators, (3) an initial load of 4,000 kw., and (4) a suitable transmission system. The estimated cost is £227,000. It is estimated that with the load factor obtainable such a power station using Western Australian coal could produce power for 0.933d. per kilowatt-hour, which is considerably below present costs both as regards those mines which generate their own power and those which are purchasing in bulk from the Kalgoorlie E. L. & P. Corporation. It is unlikely that any immediate result will follow from this report. In the first place the Western Australian Government will probably wait and see what the committee appointed by the Commonwealth Development & Migration Commission (referred to in a recent letter) has to say, and in the second place it may not be a very simple matter to get the companies to agree to take their power from a central station, especially if it means the outlay of any capital in plant reorganization; and still again the government cannot simply step in and take over the Kalgoorlie Electric Light & Power Corporation's connections without some compensation, which may mean a higher capital cost.

Many thousands of pounds have been spent in working the ancient river beds found under the basalt in various parts of Victoria. These alluvial deposits are generally referred to as the deep leads. In a few cases handsome returns have been obtained, but in recent years the results have been disappointing. Latterly interest has been confined to the development of the Langi Logan leads at Ararat, but it is now announced that the Langi Logan United Co., which is the last remaining deep lead mine, is to close down owing to inability to make ends meet. The difficulty of obtaining experienced miners and the high cost of supplies have so affected operations that values of upwards to 1 oz. per fathom cannot be made to pay.

# Johannesburg Letter

**By John Watson**

*Special Correspondent*

## Transvaal Gold and Diamond Production Continue at Record Rate

**Johannesburg, Nov. 16**—The output of Transvaal gold for October, as declared by the Chamber of Mines on Nov. 10, was 853,296 oz., having a value of £3,624,571. These figures show an increase over the previous month of 13,357 oz. and £56,737 in value. The October figures have been beaten only once previously, and that was in July last. Taking the daily average output, October showed 32,819 oz. per day and July 31,857; but July had only four Sundays, whereas October had five. The native labor returns show 3,550 fewer "boys" working on the Rand gold mines. This is attributed to natives leaving the mines to get on with hoeing and plowing at their homelands, at this season of the year.

### Platinum Report Issued

Onverwacht Platinum, Ltd., issued on Nov. 9 the following results for October: Ore milled, 1,423 tons; crude platinum produced, estimated, 618 oz. of platinoids, equal to 8.7 dwt. per ton milled. Crosscutting on the 350 level has proved a payable zone of 574 sq.ft., of an average value of 4 dwt. per ton.

A discovery of gold is reported in Southwest Africa. General Jonbert Pienaar has brought samples of quartz to Capetown, some of which assayed by the National Bank are said to have averaged 5½ oz. per ton. A London syndicate is at work on a reef which shows thicker below the surface than was indicated by the outcrop. This reef apparently runs along a series of hills parallel to the coast. Certain Johannesburg representatives have pegged claims below the hills, on the plain.

### Diamond Production Increases

The Transvaal output of alluvial diamonds for September reached a record value of £476,725, which is considerably more than one-third of the total Union diamond output and is £197,588 more in value than the total for the previous month. Out of this total, the Farm Nitgovenden (Elandsputte and Treasure Trove) contributed £295,697. The luckiest of the individual diggers was one man working alone on Drogepan (Ventersdorp district), who registered finds aggregating a value of £11,199 for his month's work.

On the Johannesburg Stock Exchange during the past week business has been considerable, London orders contributing largely. Prices of gold shares have been irregular. Government Areas show a rise of 2s, from 165s to 167s. New Modders have risen 1s. 3d. from 100s. 3d. to 101s. 6d. Sub-Nigels have again been active and their price has improved from 59s. 1½d. to 60s. 7½d. during the week. Potgietersrust platinums have been active, closing the week at 8s. 7d. (per 5s. share). African and European Investments have risen from 19s. 4½d. to 24s. 3d. during the week.

# Industrial Leaders Honor James H. McGraw

## *Business and Professional World Tender Him a Dinner to Commemorate His Years of Service and Accomplishment*

THE forty-one years of service to engineering and industry rendered by James H. McGraw, president of the McGraw-Hill Publishing Co., were commemorated on Friday evening, Dec. 17, when his friends and admirers tendered him a dinner at the Hotel Astor. On this day also fell Mr. McGraw's sixty-sixth birthday, the dinner thus serving a double purpose. Among the thousand and more people that filled the grand ballroom of the Astor were many who are distinguished in professional, business, and industrial walks of life. The sponsors included Secretary Hoover, Thomas A. Edison, General Guy E. Tripp, chairman of the Westinghouse company; Gerard Swope, president of the General Electric Co., and Owen D. Young, chairman of the General Electric board. Arthur Williams, vice-president of the New York Edison Co., was toastmaster of the occasion.

Characterizing Mr. McGraw as a "sane idealist," General Tripp, addressing the diners, said that it was obvious that idealism was not out of place in a successful business—the kind of idealism which was one of the foundation stones upon which Mr. McGraw had built his great institutions. Idealism was a valuable asset, the speaker said, and business men often overlooked that fact.

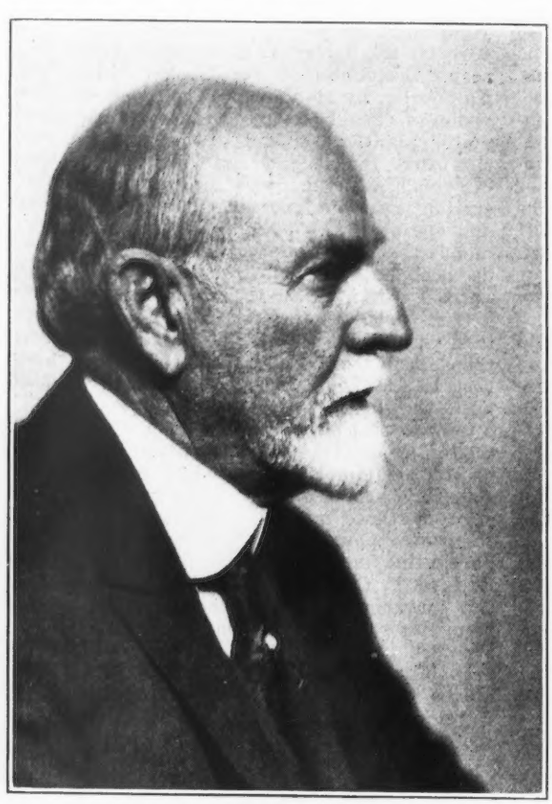
"For example," said General Tripp, "look at 'superpower.' A good many of us thought 'superpower' was merely an ideal and ought not to be discussed too much by practical men.

"Now it develops that, due to our lack of vocal imagination, the former governor of a great state is heading a movement for 'giant power' under which he says the water-powers of the wilderness will be no longer useless and the coal fields will be brought to the prairies. That is nothing more than 'superpower'—the very thing which the electric industry has been doing for a number of years and trying to keep quiet about.

"The public," said General Tripp, "would now have a sounder conception of the public utility holding company if we had loosened up a little in ventilating our ideals."

Mr. McGraw's ideals, to which General Tripp referred, were described by E. J. Mehren, vice-president of the McGraw-Hill company. Mr. McGraw, he said, held to a threefold purpose of the business press: First, to be a collector and distributor of information; second, an interpreter of events and trends in its profession or industry; and third, a promoter of sound thought, a leader in the formulation of sound policy.

The principles were many that Mr. McGraw had brought to bear upon his work. The few that he had time to mention, the speaker said, could be summed up under one head—namely, his insistence upon a very high standard of workmanship. The qualities similarly could be put into one group and consisted of an ardent spirit of service, of faith, vision, courage, and perseverance. Finally, said Mr. Mehren, these principles and qualities had been made active and effective by an intense spirit of application.



**James H. McGraw**

Mr. McGraw had an uncanny faculty of sensing publishing possibilities, said Mr. Mehren. He was the best example in the institution of hard, intelligent work and sacrifice for an object.

Replying to the many tributes paid him Mr. McGraw told what the principles were upon which he and his associates had built.

"We have believed, too, that when any large purpose was in view the sole objective should be its accomplishment, and there should be no jealousy or selfishness in the means used to attain the objective. We have never wanted to stand alone in any effort if other agencies could help, nor did it matter whether we or someone else originated the idea. Our part would be played as vigorously in the one case as in the other. We have, therefore, co-operated with all agencies which have worked in a forward-looking attitude for the advancement of the engineering profession and industry; we have co-operated with the engineering societies, national and local, with trade and industrial associations of every kind; with government agencies; with research bureaus.

"We try to be optimistic in our work; optimistic as to engineering and industry; optimistic as to the future of America. I feel that optimism is one of the essentials of leadership.

"Finally, we have had the faith that sincere and needful service would be repaid with ample means for rendering the service. We have believed that if we gave we should eventually receive, and have not been disappointed.

"Looking back over these almost forty-two years of publishing activity, I have had many satisfactions. One of these is the fascination of the work—the joy of the job—and among the joys, and at the same time one of the most durable satisfactions of life, is the building of men. Men consciously working for an ideal with themselves grow as the ideal takes shape. Browning said, 'Man's reach must exceed his grasp, else what's a Heaven for?' The editor who will reach farther and farther gets more of the ideal within his grasp till he makes his paper not only human, but vibrant with life, instinct with a sense of a mission.

"I rejoice in the engineers and industrialists with whom I have worked, and of whom you are representative tonight. I recall with pleasure the movements that we have jointly fostered. I survey with wonderment the astonishing progress that you, my own friends, have wrought in electricity, in urban transportation, in mechanical, civil, and mining and chemical engineering. You, my friends, have remade the physical conditions of the civilized world in these forty years. Whatever my own shortcomings, I have a right to be inordinately proud of my friends—of you and your accomplishments. You have been, in very truth, the creators and builders of our modern material civilization. You have been the advance guard of higher standards of living for all the people, and have created the instruments which have brought these standards into the lives of the humblest citizens. You engineers, through your basic discoveries, you industrialists, through the application of power to the productive process, have made the age of steam and electricity the servitor of the whole people. For the privilege of having served in this ministry I have you to thank, for your co-operation has made it possible.

## Engineers and Legislators Dine Together in St. Louis

Under the auspices of the St. Louis Institute of Consulting Engineers, a dinner was given to the Senators and Representatives-elect from St. Louis and St. Louis County, at the University Club in St. Louis, Mo., on Dec. 14. It is reported that the occasion was a great success; even more so than the affair that was held two years ago.

On the program the words "Get acquainted with your neighbor—you may like him; particularly your engineer—he may help you" indicated the spirit of this meeting of engineers and representatives of the government. The toastmaster of the occasion was Philip N. Moore. The speakers and their topics were as follows: A. P. Greensfelder, "Parks for Missouri"; Charles M. Talbert, "The State and Public Safety"; Edward E. Wall, "Water Supplies"; Arthur Thacher, "State Geological Survey"; William C. E. Becker, "Some Limitations"; Erle Ormsby, "Smoke"; Charles E. Smith, "Transportation—City and State."

The guests were Charles Albrecht, J. H. Ahrens, Horace G. Beedle, Frank O. Bittner, William F. Depelheuer, T. J. Ferris, Louis C. Hehl, Albert A. Huber, Michael Kinney, Joseph Mogler, O. J. Papke, Harry C. Praechter, Jones H. Parker, Richard F. Ralph, Clifford C. Rens, Louis A. Riener, W. R. Schneider, William Schwartz, George W. Wackman, Frank B. Warner, Hugo Weismantel, and A. C. Wilson.

## D. W. Brunton and Zay Jeffries Will Be Awarded Medals

D. W. Brunton, consulting mining engineer, of Denver, and Zay Jeffries, metallurgical engineer, of Cleveland, will be respective recipients of the William Lawrence Saunders medal and the James Douglas medal, to be awarded at the annual meeting of the American Institute of Mining and Metallurgical Engineers in New York next February. This will be the first presentation of the Saunders medal, which goes to Mr. Brunton for development and exposition of the principles and practice of ore sampling; for systematic daily mapping of mine geology; for the Brunton mining compass; and for engineering achievements in connection with modern high-speed tunnel driving. Articles describing his activities have appeared at different times in the *Transactions* of the Institute and in book form. The medal was established in honor of one of the Institute's former presidents.

Dr. Jeffries is the fifth recipient of the Douglas medal. This is given for distinguished achievement in non-ferrous metallurgy and was established in honor of Dr. Douglas, twice president of the Institute.

## Lehigh to Have New Laboratory

Charles Russ Tichards, president of Lehigh University, has announced that the university will erect a new electrical and mechanical engineering laboratory, which will be one of the finest in the country.

# An Adventure in Oil Shale

### R. M. Catlin Addresses Joint Meeting of New York Sections of Institute and Mining and Metallurgical Society

On Dec. 16, 1926, at a joint meeting of the New York sections of the A.I.M.E. and the Mining and Metallurgical Society of America, presided over by H. K. Masters and J. E. Spurr, the address of the evening was presented by R. M. Catlin. Mr. Catlin took as his subject "Mass Production as Applied to Shale Oil." A large gathering indicated the interest taken in oil shale. Mr. Spurr, who introduced the speaker, stated that the meeting was a continuation of the discussion of this hopeful industry held recently by the New York Section of the Mining and Metallurgical Society of America, at which Guy C. Riddell presented a paper.

Mr. Catlin reviewed the hydrocarbon situation, bringing out the well-known facts, which are to the effect that at the rapidly increasing rates of consumption, the domestic petroleum industry will be unable within relatively few years to meet the demand and recourse to foreign sources of petroleum will be necessary. He stated that if there is now a question about the present supply of hydrocarbons, the problem of the future supply becomes still more important. He said: "Control of an oil supply will be one of the most potent factors for peace." He emphasized the need for a sure supply of hydrocarbons within the boundaries of the United States. Continuing he said: "Nature seems to have foreseen the early depletion of petroleum and to have locked up in the oil shales the greater part of her hydrocarbon resources. It requires a carefully planned action to produce shale oil. Hydrocarbon resources in oil shales can be accurately measured and they do not migrate." The almost unlimited quantity of oil shale was commented upon, and Nevada deposits were described.

Having thus developed the fact of adequate supplies of oil shale, Mr. Catlin described his mass production of shale oil by a continuous process which was worked out at his plant near Elko, Nev. The unit consists of a vertical retort of about 250 tons' capacity per day. It is square in section, the side walls inclining inward from the grate area to the top. The feed conveyor system is closed and discharges into each unit in such a way as to keep it filled with crushed shale, maximum size passing a 3-in. ring, from the grate area to the top. Close to the top of the furnace is an eductor pipe for the purpose of drawing off surplus air, moisture, and any steam or gases that escape from the distilling zone below. These vapors, drawn off under a low suction, are sent to a separate condenser unit. The grate is a mechanical grate of the rocker type, the individual elements of which are actuated by oil cylinders which permit of varying the degree of agitation given the column of material within the shaft. Beneath the grate is a supplementary grate, which retards the downward movement of the spent residues, and beneath this is a deep hopper, which is equipped with a gate at its lower outlet. This discharges upon a conveyor, common to a number of units, and in turn discharges into cars by which the spent shale is transported to the waste dumps.

At a point 9 ft. above the grate and in the vertical axis of the unit is an inverted funnel-shaped pipe for drawing off the gases. This connects by a short horizontal pipe to a header (common to a number of units), and this header conducts the gases to the condenser system. Just below the grate region, and in the side of the upper part of the spent residues hopper, a pipe connects with the circulating gas header, which is common to a number of units.

The operation of the unit is described as follows: The column of shale descends continuously at a slow rate and is constantly agitated by the action of the grate, thus breaking up channels and preventing hang-ups. The zone immediately above the grates is the fire zone, and in this the combustion of the fixed carbon, remaining in the shale residues after distillation, is affected by blowing a continuous stream of inert gas, with which is thoroughly mixed a given proportion of air, through the lower header and into the space in the spent residues hopper above the pile of spent residues. This inert gas and air is warmed by passing through the burnt residues resting upon the lower grate, and then, passing up through the upper grate, supports combustion and transfers the heat thus engendered to the zone immediately above, where the shale is subjected to distillation and the gaseous products are drawn off through the upper header. There is thus a continually descending column of shale, through the interstices of which passes upward a rapidly moving volume of highly heated gases resulting from the combustion in the zone immediately below. The lower part of the distilling zone is continuously supplying spent residues containing fixed carbon to the upper part of the heat-producing zone. The proportion of air mixed with the inert gases and the velocity with which the gases move upward determine the rate of combustion and consequently the rate of distillation and of handling shale.

Mr. Catlin discussed the heat balance of the retort and showed that the combustion of the fixed carbon in the distillation residues was more than sufficient to supply heat for the retorting process. He also showed plans, made in 1921, for an eight-unit plant and described these by reference to lantern slides. Crude oil costs vary with local conditions, he said, but in the Elko plant it has been determined that 27 hp.-hr. per ton of shale and 44.4 tons per man-shift represent the power and labor ratios necessary for the operation of a plant containing eight units. Recovery of the crude distillate was 90 per cent of the theoretical possible amount. Plant cost was under $300 per ton of shale per day, a plant for the handling of 1,600 tons of shale per day representing a cost of $480,000.

# People You Should Know About

**J. B. Tyrrell,** of Toronto, Canada, is convalescing after a severe surgical operation.

**Dorsey Lyon,** of the U. S. Bureau of Mines, is visiting Western stations of the Bureau.

**M. J. Dailey,** general manager of the Silver King Coalition Mines Co., recently visited Butte on business.

**Basil Prescott,** geologist, is now associated with Chief Consolidated Mining Co. at Eureka, doing geological work.

**E. H. Watson,** consulting geologist of Sale Lake City, recently visited the oil fields of eastern Utah, Colorado, and Wyoming.

**F. P. Mennell,** the well-known Rhodesian geologist, who was recently in Johannesburg on business, has returned to Bulawayo.

**Frederick M. Feiker** has been appointed executive secretary of the Associated Business Papers, succeeding **Jesse H. Neal.**

**C. B. Kingston,** consulting mining engineer, of the Anglo-American Corporation, left Johannesburg for Broken Hill, Northern Rhodesia, on Nov. 6.

**Charles S. Smith,** president of the Old Dominion and Arizona Commercial mining companies, was in Globe recently on a trip of inspection.

**R. M. Atwater, Jr.,** of New York, vice-president of the Seneca Copper Co., was a recent visitor at the property in the Michigan copper district.

**Maurice W. Summerhayes,** mining engineer of Toronto, has left that city for California. He expects to return to his Canadian headquarters in January.

**C. H. Birdseye,** chief of the topographic branch of the U. S. Geological Survey, was in Salt Lake City recently, investigating topographic needs of the country.

**J. Fred Johnson,** mining engineer, of Eureka, Utah, is in San Francisco for a short visit. Mr. Johnson recently completed concreting the Morning shaft at Mullan, Idaho.

**F. T. Morris,** of Harper-McDonald & Co., has completed survey at the property of the Ardsley Butte Mines Corporation, and a crosscut will be driven to tap the north vein.

**A. M. Chisholm,** of Duluth, a director of the Shattuck-Denn mining corporation, stopped off in Bisbee recently for a few days on his way home from a vacation trip to Honolulu.

**J. W. Morrison,** consulting engineer, of Haileybury, Ont., will make an examination of the property of the Grozell Mining Co. in the Kirkland Lake area of northern Ontario.

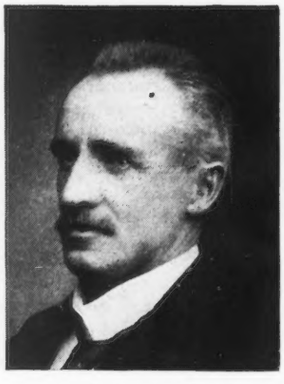
**H. D. MacDonald,** engineer for the United States Smelting, Refining & Mining Co., has returned from the Rouyn district of Quebec, after examining several mining properties.

**Gavin Hildick Smith,** lately manager of the Nourse Mines, who has been nearly twenty years on the Rand, left Johannesburg on Nov. 5 to accept a professional appointment in Spain.

**J. M. Callow,** metallurgical engineer and president of the General Engineering Co., has left Salt Lake for New York after a stay of several months at the Utah headquarters of the company.

**Arthur Kendall,** lately on the underground staff of the Nevada Consolidated Copper Co., has accepted the position of assistant superintendent with the Carson Hill Gold Mines, Inc., Melones, Calif.

**A. Gibb Maitland,** government geologist of Western Australia, after thirty years' service in the department, is soon to retire. Mr. Maitland was educated at the Yorkshire College of Science, England. He was appointed



*A. Gibb Maitland*

assistant government geologist of Queensland in 1886 and to his present position in 1896. He is the author of many geological reports published by the Geological Survey of Queensland, the Government of British New Guinea, and the Geological Survey of Western Australia.

**A. I. Jonas,** of the Geologic Branch of the U. S. Geological Survey, who was appointed assistant geologist on Dec. 1, has returned to Washington from field work in Pennsylvania, Maryland, and Virginia.

**John W. Beard** has recently been appointed superintendent of the Ojuela unit, Cia. Minera de Pèñoles, S. A., Ojuela, Durango, Mexico, having been transfered from the Sierra Mojada unit of the same company.

**Edward E. Nelson,** mechanical engineer, and a graduate from the University of New Hampshire, has been retained by the Premier-Paymaster, of Porcupine, for designing in connection with their project for expansion.

**W. Mont Ferry,** managing director of the Silver King Coalition Mines Co., and president of the American Silver Producers' Association, has been in New York to attend the meeting of the board of directors of the silver organization.

**P. E. Gummeson,** assistant manager of the Idkerberget and Dalarne Mining companies, of Idkerberget, Sweden, visited Utah mines recently representing the Royal University of Technology of Stockholm, for which he is preparing an address on his findings.

**C. E. Erdmann** of the Geological Branch of the U. S. Geological Survey, will attend the meeting of the Geological Society of America at Madison, Wis., and confer with D. J. Fisher at Chicago regarding work in the Book Cliffs region in Colorado and Utah.

**C. T. Eastman,** who has been general manager for the Mono Mining Co., of Nevada, near Sweetwater, during the construction period, has resigned to become manager for the Western Mines Development Co., of New York. He has been succeeded by **Charles F. Pugh,** a well-known Nevada operator.

**Frank Corwin,** who has been associated with the American Metal Co. for the last two and a half years, has resigned his position as assistant manager and chief engineer of the U. S. Metals Refining Co., Carteret, N. J., to accept a position as assistant to E. W. Rouse, general superintendent of the Baltimore Copper Smelting & Rolling Co., Baltimore, Md.

**P. P. Butler,** formerly superintendent of the Copper Queen smelter of the Phelps Dodge Corporation, at Douglas, Ariz., who resigned a few months ago because of ill health, has returned from La Jolla, California, very much improved physically and is now taking the mining administration post-graduate course under Dr. E. P. Mathewson at the University of Arizona, Tucson, Ariz.

**Dr. Carlton D. Hulin,** formerly assistant professor of geology at the University of California, is now serving the Compania de Real Del Monte y Pachuca, at Pachuca, Hidalgo, Mexico, in the capacity of chief geologist. The Compania de Real Del Monte y Pachuca is a subsidiary company of the United States Smelting, Refining & Mining Co. Dr. Hulin has just completed for the last-mentioned company a geologic study of the Sunnyside mine, which is situated in the San Juan region of Colorado.

**Evan R. Stanley,** who carried out a comprehensive geological survey of New Guinea in 1922, is given full credit for the discovery of the rich gold deposits lately found in the Mandated Territory inland from Rabaul. On the map made by Mr. Stanley were marked the positions where he believed gold would be found, and these included the Edie Creek (or Morobe) gold field, where rich finds have now been made, and which is creating quite a sensation in Australia, and particularly in Queensland.

**Dr. R. R. Sayers,** chief surgeon of the Bureau of Mines, and **Daniel Harrington,** chief engineer of the Bureau's Safety Division, recently visited the Porcupine camp, in Ontario, to observe operating practices there in their relation to health and safety. Dr. Sayers and Mr. Harrington will acquaint interested operators with the experience in this country in handling similar problems. It is believed that the exchange of information of this character will be beneficial to the industry in each country.

# Recent Technical Publications

Reviews, Abstracts, and References

## A Spanish-English Dictionary

**A Dictionary of Spanish, Spanish-American, Portuguese and Portuguese-American Mining, Metallurgical, and Allied Terms.** By Edward Halse. Third edition, containing an enlarged English-Spanish-Portuguese supplement. Charles Griffin & Co., Ltd., 42 Drury Lane, W. C. 2, London, England. Price 15s.

This well and favorably known volume was first published in 1908, a second edition appearing in 1914. It has now been revised and contains a valuable supplement giving the Spanish and Portuguese equivalents of the principal English mining terms.

The same firm, five or six years ago, also published a vocabulary of Russian-English and English-Russian mining terms and relative technical words, by C. W. Purington, which is for sale at 7s. 9d.

**Mineral Resources**—Recently issued separates of "Mineral Resources of the United States, 1924," published by the U. S. Bureau of Mines, and for sale by the Superintendent of Documents, Washington, D. C., at the prices indicated, are as follows: "Petroleum," by G. B. Richardson and A. B. Coons, pp. 73, 15c.; "Gold, Silver, Copper, Lead, and Zinc in Nevada," by V. C. Heikes, pp. 31, 5c.; and "Gold and Silver," by J. P. Dunlop, pp. 38, 10c. The 1925 series has also begun to appear, the separates so far released including: "Gold, Silver, Copper, Lead, and Zinc in the Eastern States," by J. P. Dunlop, pp. 6, 5c.; "Fluorspar and Cryolite," by Hubert W. Davis, pp. 18, 5c.; "Antimony," by J. W. Furness, pp. 9, 5c.; "Bauxite and Aluminum," by James M. Hill, pp. 13, 5c.; and "Carbon Black Produced from Natural Gas," by G. R. Hopkins, pp. 3, 5c.

**Tasmanian Mining**—The report of the Tasmanian Secretary for Mines for the calendar year 1925 has been issued recently, pp. 31, and is obtainable from the Secretary for Mines, Mines Department, Hobart, Tasmania. The value of all minerals produced during the year was £1,700,861, an increase of £204,057 over 1924. Copper, tin, silver-lead, limestone, zinc, and osmiridium were the products of chief importance.

**Map of Rouyn, Quebec**—H. S. Crabtree, 41 Standish Ave., Toronto 5, Ont., has published a map of the Rouyn Copper-Gold Area, showing the boundaries of the prospects in the central area of the camp. The size is 12x15 in., the scale being ¾ in. to the mile. Copies can be supplied "at attractive prices."

**Surveying** — Scientific Paper of the U. S. Bureau of Standards, No. 534, is a discussion of the "Effect of Concentrated Loads on the Length of Measuring Tapes," pp. 9, by Lewis V. Judson. Three formulas used in the standardization of geodetic base line tapes are verified. The paper is obtainable for 10c from the Superintendent of Documents, Washington, D. C.

**Underground Surveying**—The August issue of the *Bulletin* of the Institution of Mining and Metallurgy (Cleveland House, 225 City Road, London E. C. 1) contains 52 pages of discussion of L. H. Cooke's paper in the April *Bulletin* on "Underground Orientation by Exact and Approximate 'Alignments' of Plumbwires in One Shaft."

**Metallurgical Accidents**—The U. S. Bureau of Mines recently published Technical Paper 395, "Accidents at Metallurgical Works in the United States During 1924," by William W. Adams, copies of which are obtainable for 10c. each from the Superintendent of Documents, Washington, D. C. The report is restricted to non-ferrous mills and smelters. The number of employees was 59,196, an increase over 1923 of 2,325, who worked 18,884,463 man-shifts. Accidental deaths numbered 55, compared with 58 in 1923.

**Mine-Air Flow**—G. E. McElroy, of Butte, contributed a short paper to the Pittsburgh meeting of the A.I.M.E. on some of the theoretical considerations in mine-air flow, with comment on experimental results. Copies of this paper, No. 1606-A-F, are obtainable from the Secretary, A.I.M.E., 29 West 39th St., New York City.

**Californian Borax**—Bulletin 785-C of the U. S. Geological Survey, Washington, D. C., pp. 17, obtainable on request, is a geological discussion by L. F. Noble on "Borate Deposits in the Kramer District, Kern County, California." The deposits are of ulexite and colemanite, were discovered in 1913, and are now controlled by the Pacific Coast Borax Co.

**History of the Rand**—The Rand's fortieth birthday was recently celebrated, with special issues of many of the South African publications. *The Mining and Industrial Magazine*, of Sept. 8 (Johannesburg; price 6d.) had several articles descriptive of early days on the Rand and on the discovery and development of the district.

**Early Californian Mining**—T. A. Richard contributed a 24-page paper to the October *Bulletin* of the Institution of Mining and Metallurgy on "The Later Argonauts," describing conditions at the time of the gold rush to California, three-quarters of a century ago. Copies are obtainable for 1s. 9d. each from the Offices of the Institution, Cleveland House, 225, City Road, E. C. 1, London, England.

**British Guiana Diamonds**—The Economic Geological Survey has recently published a report by H. J. C. Connolly, pp. 103, on a "Preliminary Survey of the Mazaruni and Peruni Diamond Fields, British Guiana." The report covers field work done in 1925 and discusses the possibilities of developing deposits of other minerals as well as diamonds. Several sketch maps are included. The report is published by The Crown Agents for the Colonies, 4, Millbank, London, S. W. 1, England.

**Pennsylvania Geology**—The Pennsylvania Geological Survey, Harrisburg, Pa., has recently published several new sections of its topographic and geologic atlas of the state. No. 37, on the Greensburg Quadrangle, pp. 162, is by Meredith E. Johnson; No. 65, on the Punxsatawney Quadrangle, pp. 145, is by George H. Ashley; No. 178, on the New Holland Quadrangle, pp. 40, is by Anna I. Jonas and George W. Stose; and No. 206, on the Allentown Quadrangle, pp. 195, by Benjamin Leroy Miller. Geology and mineral resources are discussed in detail, and numerous colored maps are appended.

**Gold Mining**—The October *Bulletin* of the Canadian Institute of Mining and Metallurgy (603 Drummond Building, Montreal; price $1) contains a 24-page paper by John B. Phillips on "Underground Operations at the Dome Mines." The treatment of the subject is somewhat elementary, it being written by a student at McGill.

**Wood Preservation**—In the *Bulletin* just mentioned there are also two papers on wood preservation. One, by R. D. Prettie, pp. 12, is entitled "The Preservation of Wood," and includes brief descriptions of the Bethel, Lowry, Rueping, Burnett, and Card processes; the other is a 5-page paper by George Booth on "The Preservation of Mine Timbers," in which the Rueping, Lowry, and Colman processes are mentioned.

**Pittsburgh District**—For the recent meeting of the A.I.M.E. in Pittsburgh, an attractive guide book of 154 pages was prepared by M. W. von Bernewitz, describing the various points of interest thereabouts. It is possible that additional copies can be obtained from Mr. von Bernewitz, care U. S. Bureau of Mines, Pittsburgh.

**Portland Gold**—In its December issue, *Compressed Air Magazines* (11 Broadway, New York; price 35c.) begins a continued story descriptive of the Portland Gold Mine, at Cripple Creek, Colo. The first instalment has to do with the early history of the property. The author is C. H. Vivian.

**Mexican Mining Law**—*The Mexican Magazine* (Apartado 2.919, Avenida Juarez 105, Mexico City) has published the "Regulations of the Law of Mineral Industries, July 31, 1926," translated into English by R. G. Hershberger. It forms a bulletin of 96 pages and may be obtained from the publishers for 3 pesos.

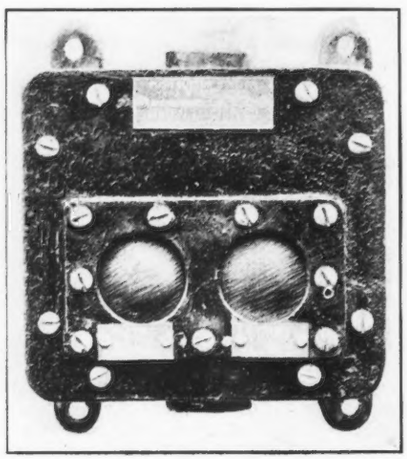
**Flotation of Lead Carbonate**—I. H. Stanley, mill superintendent of the Shattuck-Denn company, gives a brief description of the flow sheet at that property in the October number of *The Mining Congress Journal* (Washington, D. C.; price 30c.). The ore is siliceous lead carbonate, containing gold and silver, and is treated by flotation, using sodium sulphide, sodium silicate, xanthate, tar, and a frothing oil.

**Montana Earthquake**—The U. S. Geological Survey, Washington, D. C., has recently published a paper on "The Montana Earthquake of June 27, 1925," Professional Paper 147-B, pp. 17, by J. T. Pardee, describing its extent and effects, with numerous illustrations. Copies are obtainable on request.

# New Machinery and Inventions

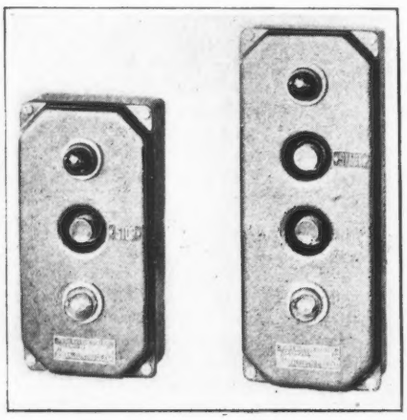
## Remote Control Equipment for Motors Favored

Remote control of electric motors is gradually finding favor in the metal-mining industry, because this method has so far proven satisfactory. A number of improved push-button stations, for use with various types of industrial magnetic control, have been introduced recently by the General Electric Co., Schenectady, N. Y. These cover various fields of application, each being designed to meet some special set of circumstances.



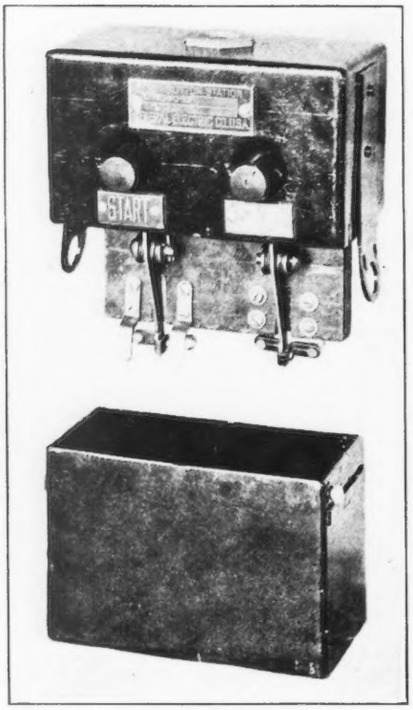
*This push-button station is watertight*

A standard dust- and water-tight push-button station of particular value in screening plants, tipples, coke plants, etc., is embodied in a design bearing the designations BS-8-E and BS-4-AA, "Stop" and "Run—Stop" respectively. These have silver contacts inclosed in a malleable iron box with a leather diaphragm between the buttons and holes in the cover, the pressure on the leather diaphragm operating the switch.



*Indicating lamps are provided*

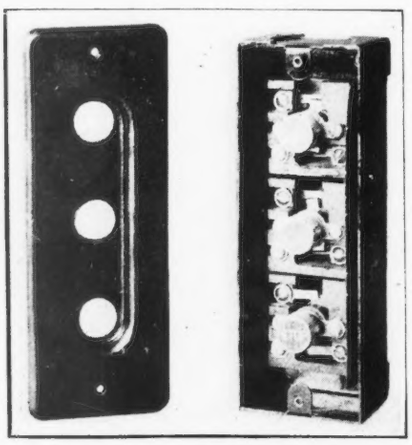
Where it is necessary to have contacts immersed in oil to minimize the danger of explosions or to prevent corrosion of the copper contacts, the "Stop" and "Start—Stop" stations bearing the designations BS-11-CL and BS-12-DK are recommended. These are specially designed to allow easy removal of the tank for filling with oil.



*Contacts may be immersed in oil*

Another form is a standard three-button station designated BS-73 and developed as an inexpensive device for light duty without plugging. This is recommended for such service as valve control, small hoists and the like. Three forms are available: (A) With buttons marked "Forward," "Reverse" and "Stop"; (B) with markings "Raise," "Lower" and "Stop," and (C) marked "Open," "Close" and "Stop."

A push-button station provided with protected indicating lamp is covered by types BS-11-DP, BS-12-HV and BS-12-HW. Eighteen-volt, resistance-type lamps are used, instead of the bull's-eye, 115-volt type, improved protection being provided by the resistor which always limits the control current to a safe value for the contacts. The three types cover "Stop," "Start—Stop" and "Fast—Slow" markings and are standardized for 125 volts, although stations for any other common voltage can be supplied.



*This type is for switchboard mounting*

An improved line of stations for back-off-panel mounting where the front is to be flush with the front of the base has also been announced. Examples are the BS-11-DG ("Stop") and BS-12-FR ("Start—Stop") forms, designed for mounting on any base between 1 and 1½ in. thick. In installing the new stations, a cover can be removed after mounting in order that connections can be made as desired.

## Catalogs

**Pumps**—The Browne valveless pump, made by the Brown Company, Portland, Me., is described in an 18-page catalog.

**Painting**—The Dunn Painting Machine Co., 835 Howard St., San Francisco, has issued a bulletin covering the Dunn single-hose line paint-spraying equipment.

**Dredging Machinery**—Morris Machine Works, Baldwinsville, N. Y. Sand and dredging pumps and hydraulic dredge machinery are covered in Bulletin 125.

**Thawing Tools**—The Aeroil Burner Co., Inc., 266 Hudson Ave., Union City, N. J., in Bulletin No. 52 covers its line of concrete heaters, thawing torches, mortar heating pans, salamanders, water heaters, and furnace burners and other tools for thawing.

**Shovel**—The St. Louis Power Shovel Co., 322 Chemical Building, St. Louis, has just completed a bulletin covering the improved all-steel Conway shovel as applied to tunnel and mining work.

**Diamond Tools**—"The Diamond and Industry" is the title of a book published by the Wheel Trueing Tool Co., Detroit, to aid the company using diamonds and diamond tools.

**Fans, Blowers**—Bulletin 8001 of the American Blower Co., Detroit, Mich., is devoted to American "Sirocco" fans and blowers. Bulletin 2004 covers the Type SE steel plate blower.

**Flotation**—The Southwestern Engineering Corporation, 1221 Hollingsworth Building, Los Angeles, Calif., has issued a booklet entitled "Notes on the Flotation Process." It consists of a series of articles by Robert Lord and B. M. Snyder reprinted from *The Southwestern Bulletin.*

**Hoisting, Hauling**—Sullivan Machinery Co., of Chicago, Ill., has issued booklet No. 132, "Handy Hoisting and Hauling," the purpose of which is to show the wide variety of applications of small portable air and electric hoists.

**Motor Control**—The MT motor control system for d.c. motors is covered in catalog GEA-451, issued by the General Electric Co.

**Gears**—Bulletin GEA-482 of General Electric Co., Schenectady, N. Y., covers silent gears of "Fabroil" and "Textolite."

# Market and Financial News

### Tomboy Still Earning a Modest Profit at Telluride

TOMBOY GOLD MINES CO., Ltd., operating in the Telluride district in Colorado, treated 205,435 tons of ore, yielding $3.50 per ton, during the last fiscal year. The operating profit of $88,318 was sufficient to leave a balance of £9,285 after depreciation of plant, interest, and sundry charges. The early exhaustion of the ore reserves is forecast in the report.

### Increase in Transvaal Gold Output for Nine Months

The Transvaal Chamber of Mines has issued a monthly analysis for September, which completes the first nine months of 1926, and shows that the tonnage milled, on the whole of the Transvaal gold mines, was 22,419,499 and the fine gold produced totaled 7,433,123 oz. These agreeable figures reveal an increase of 872,871 tons and 225,341 oz. over the corresponding nine months of 1925. Working costs for the nine months of the present year average 19s., as against 19s. 3d. per ton of ore milled for the nine months of last year; the estimated working profit per ton remains at 8s. 9d. This year over £300,000 less has been distributed in dividends, the total being £3,931,168. It is estimated by the Secretary for Mines and Industry that the reduction of 1s. in working costs below the present figures (written May, 1926) would bring into the payable zone a further 36,000,000 tons of ore with a gold content of some £32,000,000.

**Mount Lyell Mining & Railway Co.**, producing copper in Australia, during the year ended Sept. 30, 1926, realized a net profit of £171,861, after allowing £15,567 for prospecting and development, £33,524 for depreciation, and £10,110 for taxes.

The report says that steps are being taken toward resumption of development and exploratory work on a larger scale. Ore reserves in the North Mount Lyell mine are 898,123 tons, assaying 6 per cent copper, 1.33 oz. silver, and 0.015 oz. gold. Figures have been arrived at by deducting from last year's ore reserves the ore won during the year after allowing for 10,000 tons of ore extracted from outside the limits of the reserves. The company concentrated 115,695 tons of North Mount Lyell ore, producing 36,605 tons of concentrates; and smelted 3,236 tons North Mount Lyell ore, 36,415 tons concentrates, and 5,154 tons pyrites. It produced 6,925 tons of blister copper, containing 6,860 tons of copper, 133,338 oz. of silver and 2,211 oz. of gold.

## Increased Prosperity Shown by Mining Dividends

The following dividends were paid in December by mining and metallurgical companies operating in North and South America. In the last column is shown the dividend yield on the stocks of the companies that are on a regular dividend basis, based on the December distribution except as noted, and on recent market prices:

| Companies in the United States | Situation | Per Share | Total | Per Cent Annual Yield |
|---|---|---|---|---|
| American Metal | U. S. and Mex. | $1.00 Q | $593,458 | 8.9 |
| American Metal pfd. | U. S. and Mex. | 1.75 Q | 87,500 | 6.1 |
| American Smelting & Ref. pfd. | U. S. and Mex. | 1.75 Q | 875,000 | 5.7 |
| Bunker Hill & Sullivan, s, l | Ida. | 0.75 M | 245,250 | .... |
| Butte Copper & Zinc, m, z, s, l | Mont. | 0.50 A | 300,000 | j11.4 |
| Butte & Superior, z, s | Mont. | 0.50 Q | 145,099 | 17.0 |
| Calumet & Arizona, c | Ariz. | 1.50 Q | 964,135 | 8.7 |
| Calumet & Hecla Consol., c | Mich. | 0.50 Q | 1,002,751 | 12.9 |
| Consolidated Lead & Zinc | Okla., Kans. | 0.125 | 25,000 | .... |
| Eagle-Picher Lead, z, l | Okla. | 0.40 Q | 400,000 | 5.7 |
| Federal Mining & Smg. pfd., s, l, z | Ida., Okla. | 1.75 Q | 210,000 | 9.2 |
| Gladstone Mountain, l | Wash. | 0.005 M | 6,609 | j23.3 |
| Golden Cycle M. & R., g | Colo. | 0.04 Q | 60,000 | j7.5 |
| Great Northern Iron Ore | Minn. | 0.75 K | 1,125,000 | j8.1 |
| Hecla Mining, l, s | Ida. | 0.50 Q | 500,000 | 12.5 |
| Homestake Mining, g | S. D. | 0.50 M | 125,580 | j11.2 |
| Inland Steel | Minn. | 0.625 Q | 739,249 | j6.3 |
| International Nickel, n, c | Ont., W. Va. | 0.50 Q | 836,692 | 5.3 |
| Isle Royale Copper | Mich. | 0.50 SA | 75,000 | 10.1 |
| Mohawk Mining, c | Mich. | 2.00 Q | 230,000 | j12.3 |
| Mother Lode Coalition, c, s | Alaska | 0.375 SA | 937,500 | 17.7 |
| National Lead | U. S. | 2.00 Q | 413,108 | 4.5 |
| National Lead pfd. | U. S. | 1.75 Q | 426,433 | 5.9 |
| Nevada Consolidated Copper | Nev., Ariz., N. M. | 0.375 Q | 1,315,959 | 9.7 |
| New Jersey Zinc | U. S. | 2.00 X | 981,632 | j6.4 |
| Night Hawk Mining, c | Ariz. | 0.25 Q | ..... | .... |
| Republic Iron & Steel | U. S. | 1.00 Q | 300,000 | 7.0 |
| St. Joseph Lead, l, z | Mo., N. Y. | 0.75 Q | 1,452,478 | 7.3 |
| Sloss-Sheffield S. & Iron | Ala. | 1.50 Q | 150,000 | 4.6 |
| Tenn. Copper & Chemical | Tenn. | 0.25 Q | 198,656 | 9.2 |
| Texas Gulf Sulphur | Texas. | 1.00 Q | 2,540,000 | 8.4 |
| Tintic Standard, s, l, c | Utah. | 0.20 Q | 230,583 | j17.0 |
| Tom Reed Gold | Ariz. | 0.02 Q | 18,191 | 20.0 |
| U. S. Steel | U. S. | 1.75 Q | 8,895,294 | 4.4 |
| United Verde Copper | Ariz. | 3.00 Q | 900,000 | .... |
| Utah Copper | Utah. | 1.50 Q | 2,436,600 | 5.4 |
| Vanadium Corporation | Various. | 1.00 X | 377,137 | j9.6 |
| Companies in other countries | | | | |
| Belmont Surf Inlet, g, c | B. C. | 0.025 | 62,500 | .... |
| Chile Copper | Chile. | 0.625 Q | 2,744,528 | 7.1 |
| Hollinger Consol. Gold | Ont. | 0.10 F | 492,000 | 6.7 |
| Lake Shore, g | Ont. | 0.20 QY | 400,000 | j3.4 |
| Lucky Tiger-Combination, g, s | Sonora. | 0.12 MY | 85,840 | j15.6 |
| McIntyre Porcupine, g | Ont. | 0.25 Q | 199,500 | 3.8 |
| Total and average | | | $34,104,262 | 9.3 |

s—silver; l—lead; m—manganese; z—zinc; c—copper; g—gold; n—nickel; Q—quarterly; M—monthly; A—annually; K—irregularly; SA—semi-annually; X—extra; F—every four weeks; Y—includes extra; j—based on dividends for the last twelve months.

Mining dividends reported in these columns during the last year have amounted to approximately $239,000,000, compared with $203,000,000 for 1925, and $177,000,000 for 1924. Last year's increase over 1924 was 14.7 per cent, and this year's increase over 1925 is still greater—17.7 per cent. No more convincing proof is needed of the solid and increasing prosperity of the mining industries, and this in spite of the fact that the average prices of the important non-ferrous metals produced on this continent—copper, lead, zinc, and silver—have been lower in 1926 than in 1925. Increased production and a general lowering of costs by improvements in methods and by the adoption of labor-saving and more efficient machinery have been responsible.

Some of the shares listed herein among the mining issues are also to be considered as industrials, as, for example, U. S. Steel, New Jersey Zinc, and National Lead. But, on the other hand, some mining companies do not report their dividends, being essentially closed corporations; many others are purely private enterprises; and still others are essentially industrial companies which among other things conduct large and profitable mines and reduction plants. It would seem, therefore, that the total of so-called mining dividends herein reported—$239,000,000—is considerably less than the amount that actually inures to stockholders through mining operations in the metallic and non-metallic field, coal and oil excepted.

In December, dividends were well over those for the corresponding quarter, paid in September. This is natural, as many companies make special distributions for the holiday season. The total was slightly over that paid in December, 1925. Mohawk paid double its usual dividend, but the additional dollar is to be considered as an extra. Nevada Consolidated increased its regular distribution from 25 to 37½c. per share, and Utah Copper began paying $1.50 a share quarterly instead of $1.25, as heretofore. New Jersey Zinc paid the expected $2 extra, and Vanadium Corporation, after increasing its regu-

lar rate early in the year, paid an extra of a dollar. Lake Shore and Lucky Tiger-Combination paid extras as they did last December.

Texas Gulf Sulphur has increased its dividend in connection with its new issue of 2,540,000 shares of no-par stock; on this it has established a dividend of $1 to be paid quarterly, compared with $3 on the 635,000 shares formerly outstanding. This means an increase of 33 per cent in its former dividend rate. Golden Cycle has increased its regular quarterly disbursement from 3 to 4c.

Among the few absentees in the December dividend list is Ohio Copper, which is apparently approaching the end of the highly profitable leaching of copper ore in place that it has been carrying on for several years.

## Coeur d'Alene Has Twenty-three Active Concentrators

There are thirty-seven concentrators in the Coeur d'Alene district, having a total capacity to treat 11,345 tons of ore per day. However, only about two-thirds of these mills are being operated and these are handling about the same proportion of the total tonnage. The twenty-three concentrating mills operating today in the district represent a total rated capacity of 7,220 tons of ore per day. Of the fourteen mills inactive, a considerable number are obsolete and would require remodeling for service. Below is given a list of the mills in the district, both active and idle, with the ownership designated when necessary, location, rated tonnage and products. The *Wallace Miner*, which makes the compilation, says, "it is possible that the rated capacity is not correctly given in all cases, as the actual figures were not always available."

**Concentrating Mills in Operation**

| Mill | Location | Capacity, Tons | Kind of Concentrate |
|---|---|---|---|
| Bunker Hill & Sullivan | Kellogg | 1,200 | Lead-silver |
| Morning (Federal Co.) | Mullan | 1,200 | Lead-silver-zinc |
| Hercules | Wallace | 800 | Lead-silver-zinc |
| Hecla | Gem | 700 | Lead-silver |
| Sweeney (Bunker Hill) | Bradley | 500 | Lead-silver-zinc |
| Star (Sullivan Mining Co.) | Kellogg | 500 | Lead-silver-zinc |
| Tamarack | Frisco | 300 | Lead-silver |
| Gold Hunter | Mullan | 300 | Lead-silver |
| Page (Federal Co.) | Kellogg | 250 | Lead-silver-zinc |
| Hypotheek | Kingston | 200 | Lead-silver |
| Galena (Callahan Z-L Co.) | Wallace | 150 | Lead-silver |
| Constitution | Pine Creek | 150 | Lead-silver-zinc |
| Highland-Surprise | Pine Creek | 150 | Lead-silver-zinc |
| Jack Waite | North Side | 150 | Lead-silver-zinc |
| Alhambra (Bunker Hill) | Kellogg | 100 | Lead-silver |
| Sunshine | Big Creek | 100 | Lead-silver |
| Snowstorm (Oregon-Idaho Co.) | Mullan | 100 | Copper-silver |
| Co-operative (leasers) | Wardner | 50 | Lead-silver |
| Peebles (leasers) | Wardner | 50 | Lead-silver |
| Gem Lease | Gem | 50 | Lead-silver |
| **Tailing Mills Operating** | | | |
| Hayes | Kellogg | 100 | Lead-silver |
| Saunders | Kellogg | 100 | Lead-silver |
| Nordquist | Gem | 20 | Lead-silver |
| **Mills Not Operating** | | | |
| Callahan | Nine Mile | 750 | Lead-silver-zinc |
| Success | Nine Mile | 500 | Lead-silver-zinc |
| National | Mullan | 500 | Copper-silver |
| Ray-Jefferson | Carbonite | 400 | Lead-silver-zinc |
| Standard (Federal Co.) | Wallace | 300 | Lead-silver |
| Mammoth (Federal Co.) | Wallace | 300 | Lead-silver |
| Marsh | Nine Mile | 100 | Lead-silver-zinc |
| Big Creek | Big Creek | 100 | Lead-silver |
| Giant Ledge | North Side | 100 | Lead-silver |
| Paragon | North Side | 100 | Lead-silver-zinc |
| Monarch | North Side | 100 | Lead-silver |
| Empire Copper | North Fork | 100 | Lead-silver-copper |
| Amy-Matchless | Pine Creek | 75 | Lead-silver-zinc |
| Lincoln | Osburn | 50 | Lead-silver |

## Smuggler Union, of Telluride, Colo., Improves Position

### Income for Fiscal Year Put Into Development—Big Increase in Ore Reserves—Profit Expected

A considerable increase in ore reserves is shown in the recently issued annual report of the Smuggler Union Mining Co., which produces gold-silver-lead ores in the Telluride district in Colorado. The total as of May 1, 1926, was 519,741 tons, with a gross value of $3,504,283 with prices for gold, silver, and lead, respectively, $20, 60c. and 5c. This compares with 190,867 tons, having an estimated gross value, on the same basis, of $1,376,345, on the corresponding date in 1925.

Robert Livermore, vice-president and general manager, says: "Although the operations for the year have shown a money loss, the improved condition of the mine equipment, ore reserves, and plant is the result of devoting income to their betterment, and assuming that the value per ton is not materially affected by net variations in the prices of lead and silver from those used in the calculation of the reserves, the hope expressed in the last annual report that a moderate but steady profit could be made should be realized during the coming year."

Receipts and operating expenses (not including interest, depletion, or depreciation) for the year, on the basis of tons of ore produced by the company, with corresponding figures of the year preceding, are shown in the accompanying table.

**Smuggler Union Operating Results**

| | Year Ending April 30, 1926 | | | Year Ending April 30, 1925 | |
|---|---|---|---|---|---|
| Tonnage | 218,449 | | | 177,720 | |
| | Receipts | Per Ton | | Receipts | Per Ton |
| Gross extracted value | $1,323,039 | $6.056 | | $1,110,301 | $6.25 |
| Freight and treatment | 291,011 | 1.332 | | 192,153 | 1.08 |
| Net value | $1,032,028 | $4.724 | | $918,148 | $5.17 |
| Incidental receipts | 4,515 | .021 | | 9,312 | .05 |
| Royalties | 15,939 | .073 | | 40,211 | .23 |
| Total receipts | $1,052,483 | $4.818 | | $967,672 | $5.45 |
| Direct operating charges | $966,889 | $4.426 | | $762,576 | $4.29 |
| Indirect operating charges | 97,675 | .447 | | 86,597 | .49 |
| Boston office expenses | 22,007 | .101 | | 17,479 | .10 |
| Total operating expenses | $1,086,572 | $4.974 | | $866,652 | $4.88 |
| Loss | $34,089 | $0.156 | Profit | $101,019 | $0.57 |

Comparative figures of production for the last two fiscal years are shown below:

| | 1925 | 1926 |
|---|---|---|
| Tons ore | 200,660 | 224,258 |
| Gold, oz. | 41,071 | 37,984 |
| Silver, oz. | 502,754 | 442,544 |
| Lead, lb. | 3,727,876 | 5,519,201 |
| Copper, lb. | 15,423 | 2,372 |

## Cadmium Industry Growing

More metallic cadmium was produced in the United States in 1925 than in any other years since its isolation began in this country in 1906, according to reports made by producers of cadmium to the U. S. Bureau of Mines. Production at six plants amounted to 502,824 lb., valued at $276,553, at the average selling price of 55c. a pound. The market quotation on American metal in New York remained at 60c. a pound until early summer, when it dropped to 50c. a pound for a short time, rising again to the earlier level.

Probably the most important recent developments in the use of cadmium are in the plating industry and in the manufacture of cadmium-lithopone. Imports of cadmium are negligible. The following table shows the number of pounds of metallic cadmium produced in the United States from 1921 to 1925:

**Cadmium Produced 1921-1925**

| | Quantity Pounds | Value |
|---|---|---|
| 1921 | 68,501 | $67,131 |
| 1922 | 131,590 | 143,433 |
| 1923 | 183,816 | 161,758 |
| 1924 | 129,328 | 77,597 |
| 1925 | 502,824 | 276,553 |

**Antimony** used in the United States totals about half of the world's production. According to the U. S. Bureau of Mines, 75 per cent of the imports are utilized in the manufacture of type metal, anti-friction bearings for machinery, britannia metal, and hard metal (antimonial lead). Of the thirty-odd uses to which antimony is put, virtually all can be taken care of satisfactorily by substitutes.

# The Market Report

## Metal Markets Generally Quiet

### Lead More Active Than Copper or Zinc—Little Change in Prices

**New York, Dec. 22, 1926**—Dullness—pre-holiday or other—has characterized the week ending today in the non-ferrous metal markets. Copper, especially, was neglected; zinc business was below normal in volume, whereas lead buyers bought on an almost if not quite normal scale. Prices have changed little, although tin is somewhat weaker. Zinc is about the same and lead is unchanged in New York, but in St. Louis it may be had at 5 points under the market of last Wednesday. Silver is steady; antimony is easier; and quicksilver is firm at a fractionally better price. Sentiment continues good in spite of the quietness; and, with an optimistic view for industrial activity in the coming months a good metal business is looked for.

### Copper Bottomed at 13.50c. Connecticut

The total sales of copper for the week have been exceptionally small, probably less than 10 per cent of those of the record-breaking week of Dec. 8. Prices have ranged from 13.50c. delivered in Connecticut, to as high as 13.80c. at high-freight-rate points. Good-sized sales at Eastern points also brought from 13.55 to 13.625c. Most of the business was spread over the first quarter, with January delivery predominating. There is every indication of a good volume of buying just under the market. Potential buyers will not consider over 13½c. but most sellers are disinclined to entertain business at this level, although one small sale was made at that figure late today. Several, in fact, are virtually out of the market, with their price nominally 13.625c. Some are inclined to think that little business will develop until after the New Year, but this opinion is not universal. The export price remains unchanged at 13.95c. c.i.f., at which figure a little business is transacted each day. Figures just issued by the American Bureau of Metal Statistics indicate a new high record for primary production in the history of the industry. Part of this, however, is due to a seasonal expansion that almost always takes place in the last quarter of the year, and sellers are not worried because of a probable small increase of stocks, which they maintain still are lower than they should be.

### Lead Market Holds Steady

Except for a slight decline in prices in the Middle West, the lead market has held extremely steady all week, both here and abroad. Sales, while not large, have been sufficient to satisfy producers, so there has not been much competition on a price basis. In the New York district, practically all if not all sales have been made at the contract price of the American Smelting & Refining Co., which continues at 7.80c. Slight concessions are rumored on New England business in some instances. In the Middle West, sellers revised their prices down to 7.65c., following the decline last week in New York quotations. On Thursday and Friday some lead was sold for less than 7.65c., one sale being as low as 7.575c., St. Louis basis, but these cheaper offerings have been withdrawn during the last three days, so that now every one seems to be quoting 7.65c. In Chicago, 7.75c. rules.

Plenty of lead for any delivery is available, but few requests extend beyond January. Production has recently increased sharply, and specifications on contracts have declined a little, these being the bearish arguments. On the other hand, firmness is being shown in London, and producers are beginning to stock lead rather than sell freely at current prices. They feel that the sharp downward trends in prices during the first part of the last three years are not so likely to be duplicated in 1927, owing to the fact that lead has already had a substantial decline, so that present prices are lower than at corresponding times in 1924 and 1925.

### Zinc Prices Above 7c.

After sagging slightly below 7c., last Thursday, the zinc market has shown some signs of strength, although consumers have not been free buyers. It is believed that dealers have bought on the theory that the metal is cheap at 7c. and their purchases have tended to strengthen the market. The statistical position is good, galvanizers seem to be more optimistic than they were, and a curtailment in the Joplin district is expected as a consequence of the holiday season. These factors, together with signs of strength in London, are cited as reasons for a bullish sentiment in zinc. High-grade zinc is quiet with prices ranging from 9c. to 9¼c. in the East.

### Daily Prices of Metals

| Dec. | Copper | Tin | | Lead | | Zinc |
|---|---|---|---|---|---|---|
| | Electrolytic, N. Y. | 99 Per Cent | Straits | N. Y. | St. L. | St. L. |
| 16 | 13 375 | 67.25 | 69.125 | 7.80 | 7 65 | 6.975@7.00 |
| 17 | 13 375 | 66.50 | 68 25 | 7.80 | 7.625@7 65 | 7 00 |
| 18 | 13 35@13.375 | 66 75 | 68 375 | 7.80 | 7.625@7 65 | 7.00 |
| 20 | 13.35@13 40 | 66 875 | 68 25 | 7 80 | 7 65 | 7 00@7.025 |
| 21 | 13 35 | 66 25 | 68 00 | 7 80 | 7 65 | 7 00@7 025 |
| 22 | 13 30 | 65.75 | 67 625 | 7 80 | 7 65 | 7 025 |
| Av. | 13 356 | 66 563 | 68 271 | 7 800 | 7 646 | 7 006 |

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis; i.e., delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard.

Quotations for copper are for ordinary forms of wire bars, ingot bars, and cakes. For ingots an extra 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight rate between the two points.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

### London

| Dec. | Copper | | | Tin | | Lead | | Zinc | |
|---|---|---|---|---|---|---|---|---|---|
| | Standard | | Electrolytic | | | | | | |
| | Spot | 3M | | Spot | 3M | Spot | 3M | Spot | 3M |
| 16 | 57 | 57¾ | 64¼ | 310¾ | 300½ | 28⅞ | 29⅛ | 32 9/16 | 32⅝ |
| 17 | 57 | 57¾ | 64¼ | 307½ | 298⅜ | 29⅛ | 29⅜ | 32⅝ | 32 11/16 |
| 20 | 57⅛ | 57⅞ | 64¼ | 308⅝ | 299¾ | 29 3/16 | 29½ | 32 13/16 | 32 13/16 |
| 21 | 57 | 57¾ | 64¼ | 307 | 298 | 29 3/16 | 29 9/16 | 32⅞ | 32⅞ |
| 22 | 56⅝ | 57½ | 64¼ | 303¾ | 296¼ | 29⅛ | 29½ | 33⅛ | 32⅞ |

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

### Silver, Gold, and Sterling Exchange

| Dec. | Sterling Exchange "Checks" | Silver | | Gold London | Dec. | Sterling Exchange "Checks" | Silver | | Gold London |
|---|---|---|---|---|---|---|---|---|---|
| | | New York | London | | | | New York | London | |
| 16 | 4 84¾ | 53¾ | 24 13/16 | 84s11½d | 20 | 4 84½ | 53¼ | 24⅝ | 84s11½d |
| 17 | 4 84⅝ | 53½ | 24¾ | 84s11½d | 21 | 4 84½ | 53⅜ | 24 9/16 | 84s11½d |
| 18 | 4 84⅝ | 53⅜ | 24 11/16 | | 22 | 4 84⅝ | 53½ | 24¾ | 84s11½d |

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-half cent premium.

## Tin Drops Below 68c.

Prompt Straits tin has not been in much demand this last week, and prices have declined to the lowest level since early September, when the spurt upward to around 70c. began. A moderate amount of forward business has been placed, February tin being available at about 1½c. less than prompt, and March at about ¼c. less than February. Shipments from the East are now estimated at about 7,600 long tons for December. Consumers of tin are reported to be pretty well covered up to the middle of February.

## Silver Quiet and Slow

The silver market continued quiet with a slightly lower tendency until the 22d, when a moderate recovery occurred. China has been a negligible factor, the Indian bazaars being responsible for the changes in price. With the Christmas and New Year holidays approaching, only small business may be expected.

**Mexican Dollars** (Old Mexican pesos): Dec. 16th, 40⅜c.; 17th, 40⅝c.; 18th, 40½c.; 20th, 40⅜c.; 21st, 40¼c.; 22d, 40⅝c.

## Francs Above 4c.

Closing cable quotations on Tuesday, Dec. 21, were as follows: Francs, 4.01¼c.; lire, 4.46¾c.; and marks, 23.80c. Canadian dollars, ⅛ per cent discount.

## Other Metals

**Quotations cover large wholesale lots unless otherwise specified. London prices are according to latest mail advices.**

**Aluminum**—Both 98 and 99 per cent grades quoted at 27c. per lb. London, £107 per long ton.

**Antimony**—Per lb., duty paid, New York: Chinese brands, January and February, 13@12½c; Cookson's "C" grade, 17½c. Market continues quiet. Needle and oxide nominally unchanged from quotations in the Dec. 4 issue.

**Bismuth—Per lb., New York, in ton lots, $2.70@$2.75. London, 10s.**

**Cadmium—Per lb., New York, 60c. London, 1s. 10½d.@1s. 11d. for American metal; 1s. 10d. for Australian metal.**

**Iridium—Per oz., $120@$125 for 98 @99 per cent sponge and powder. Firm. London, £32½ in iridio-platinum; £17@ £20 for sponge and powder. Nominal.**

**Nickel — Per lb., ingot, 35c.; shot, 36c.; electrolytic, 39c. (99.75 per cent grade). London, £170@£175 per long ton according to quantity.**

**Osmium—Per oz., $70@$75. London, £16@£19.**

**Palladium**—Per oz., $63@$66. Pure metal as a constituent of crude platinum, $55@$60 per oz. London, £11@ £12, nominal.

**Platinum — Official price on refined metal, $112 per oz. Open market cash sales of large lots, $106. Pure metal as a constituent of crude platinum, $105. Market dull.**

**London, £23 per oz. for refined and £20½ for crude. Dull.**

**Quicksilver**—Per 75-lb. flask, $100, firm. San Francisco wires $99, steady. London, £17¼@£17¾.

**The prices of Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Monel Metal, Radium, Rhodium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Tungsten, and Zirconium** are unchanged from the issue of Dec. 4.

## Metallic Ores

**Manganese Ore**—Per long ton unit of Mn, c.i.f. North Atlantic ports, minimum 47 per cent Mn, 36@38. Caucasian (washed), 53@55 per cent, 38@ 40c. The market is firmer on account of smaller imports.

[1]Chemical grades, powdered, coarse or fine, 82@87 per cent $MnO_2$, Brazilian and Cuban, duty paid, $70@$80 per ton in carloads.

**Tungsten Ore** — Per unit of $WO_3$, N. Y.: Wolframite, $10.75@$11; Western scheelite, $11.25@$11.50.

**Chrome, Iron, Molybdenum, Tantalum, Titanium, Uranium, and Vanadium Ores** are unchanged from quotations in the Dec. 4 issue.

## Zinc Blende and Lead Ore Prices Continue Unchanged

**Joplin, Mo., Dec. 18, 1926**

**Zinc Blende**

| | |
|---|---|
| High | $50.70 |
| Premium blende, basis 60 per cent zinc | $47.00@ 48.00 |
| Prime Western, basis 60 per cent zinc | 46.00@ 45.00 |
| Fines and slimes, basis 60 per cent zinc | 44.00@ 41.00 |
| Average settling price, all zinc | 46.74 |

**Galena**

| | |
|---|---|
| High | $103.50 |
| Basis 80 per cent lead | 100.00 |
| Average settling price, all lead | 102.59 |

Shipments for the week: Blende, 17,638; lead, 2,849 tons. Value, all ores the week, $1,106,940.

Closing mines over the holidays rests with each individual operating company. Some will close down next Thursday night, remaining idle over Friday and Christmas day, and resume operations on Monday following. There is some talk of longer cessation at some mines, but there will be no concerted action, and the effect, while it might be estimated at this time, is entirely problematical. Closing down the mines would appear wholly unnecessary as a restrictive plan, as with a maximum number of mills in operation, and with a high rate of mill recovery, production dwindled from approximately 19,000 down to 18,000, and now down to 17,000, this week being 16,960 tons. Rapid depletion of the richer deposits is given as cause for the decline in output.

**Platteville, Wis., Dec. 11, 1926**

| Zinc Blende | Per Ton |
|---|---|
| Blende, basis 60 per cent zinc | $48.75 |
| **Lead Ore** | |
| Lead, basis 80 per cent lead | $102.50 |

Shipments for the week: Blende, 1,044 tons; lead, 100 tons. Shipments for the year: Blende, 54,286; lead, 1,866 tons. Shipments for the week to separating plants, 1,922 tons blende.

**Platteville, Wis., Dec. 18, 1926**

| Zinc Blende | Per Ton |
|---|---|
| Blende, basis 60 per cent zinc | $48.75 |
| **Lead Ore** | |
| Lead, basis 80 per cent lead | $100.00 |

[1]**Price furnished by Foote Mineral Co., Philadelphia.**

Shipments for the week: Blende, 1,116 tons; lead, none. Shipments for the year: Blende, 55,402; lead, 1,866 tons. Shipments for the week to separating plants, 1,827 tons blende.

## Non-Metallic Minerals

**Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fuller's Earth, Fluorspar, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Ilmenite Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystals, Silica, Spodumene, Sulphur, Talc, Tripoli,** and **Zircon** are unchanged from prices in the Dec. 4 issue.

## Mineral Products

**Arsenious Oxide (White Arsenic)**—3½@3¾c. per lb. Quiet. London, £16¼ per long ton for 99 per cent Cornish white.

**Calcium Molybdate, Copper Sulphate, Sodium Nitrate, Sodium Sulphate (Salt Cake),** and **Zinc Oxide** are unchanged from prices in the Dec. 4 issue.

## Ferro-Alloys

**Ferromanganese** — Domestic, 78@82 **per cent, $100 per long ton, furnace, for delivery during first half of 1927. Imported alloy, $100, duty paid. Market active. Spiegeleisen, 19@21 per cent, $36@$37 f.o.b. furnace; 16@19 per cent, $34@$35.**

**Ferrocerium, Ferrochrome, Ferrophosphorus, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferro-uranium and Ferrovanadium** are unchanged from prices in the Dec. 4 issue.

## Metal Products

**Rolled Copper**—Sheets, 22¼c.; wire, 15⅝@15¾c.; f.o.b. mill.

**Lead Sheets, Nickel Silver,** and **Yellow Metal** are unchanged from the Dec. 4 issue.

**Zinc Sheets**—11½c. per lb., f.o.b. mill.

## Refractories

**Fireclay Brick, Chrome Brick, Magnesite Brick, Silica Brick** and **Zirkite** are unchanged from quotations in the Dec. 4 issue.

## Steel Firm—Pig Iron and Coke Dull

**Pittsburgh, Dec. 21, 1926**

Steel mill operations have been a trifle heavier thus far this month than at the close of November. Unless there is a sharp decrease at holiday time the month will not show much decrease from the 80 per cent average of November, perhaps a 75 per cent rate. That would make the year about 7 per cent above 1925 in ingot production.

**Pig Iron**—Foundry iron has been offered in large lots at $18.50, Valley, the small lot market lately having been $19. Bessemer remains at $20 and basic at $18.50, and both are dull.

**Connellsville Coke**—The market is practically stagnant. Spot furnace, $3.50; spot foundry, $4.75@$5.25.

# Current Prices of Mining Supplies

## Rise and Fall of the Market

A COMPARISON of current quotations on mining supplies with those in effect a month ago reveals advances in track supplies, cut nails, galvanized sheets and zinc dust. Declines were confined to black and blue-annealed sheets, cast-iron pipe, linseed oil and manila rope. Mine timbers experienced a slight upward turn in prices during November, the first since January, 1926, taking the national market as a whole. Since then, however, levels have been sufficiently low to discourage further price concessions at the mills.

**SHEETS**—Quotations are per 100 lb. in various cities from warehouse also the base quotations from mill:

| Blue Annealed | Pittsburgh, Large Mill Lots | St. Louis | Chicago | San Francisco | New York |
|---|---|---|---|---|---|
| No. 10 | $2.30@2.40 | $3.60 | $3.50 | $3.90 | $3.89 |
| Black No. 24 | 3.00@3.10 | 4.45 | 3.95 | 4.90 | 4.35 |
| Galvanized No. 24 | 3.95@4.10 | 5.25 | 4.80 | 5.75 | 5.10 |

**STEEL RAILS**—The following quotations are per ton f.o.b. Pittsburgh and Chicago for carload or larger lots:

| | Pittsburgh Current | Pittsburgh One Year Ago | Birmingham | Chicago |
|---|---|---|---|---|
| Standard bessemer rails | $43.00 | $43.00 | $43.00 | $43.00 |
| Standard openhearth rails | 43.00 | 43.00 | 43.00 | 43.00 |

**TRACK SUPPLIES**—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

| | Pittsburgh Current | Pittsburgh One Year Ago | Chicago | St. Louis | San Francisco | Birmingham |
|---|---|---|---|---|---|---|
| Standard spikes, ⅝-in. and larger | $2.80–2.90 | $2.80 | $3.55 | $3.65 | $4.35 | $3.00 |
| Track bolts | 3.90–4.25 | 3.90@4.15 | 4.55 | 4.60 | 5.85 | 3.90 |
| Standard section angle bars | 2.75 | 2.75 | 3.40 | 3.75 | 3.60 | 4.15 |

**STRUCTURAL MATERIAL**—Following are base prices in carload lots, f.o.b. mill, Pittsburgh and Birmingham together with quotations per 100 lb. in less than carload lots, from warehouses at places named:

| | Pittsburgh, Mill | Birmingham Mill | New York | Dallas | St. Louis | Chicago | San Francisco |
|---|---|---|---|---|---|---|---|
| Beams, 3 to 15 in. | $2.00 | $2.05 | $3.34 | $4.15 | $3.25 | $3.10 | $3.30 |
| Channel, 3 to 15 in. | 2.00 | 2.10 | 3.34 | 4.15 | 3.25 | 3.10 | 3.30 |
| Angles, 3 to 6 in., ¼ in. thick | 2.00 | 2.10 | 3.34 | 4.15 | 3.25 | 3.10 | 3.30 |
| Tees, 3 in. and larger | 2.00 | 2.10 | 3.34 | 4.15 | 3.35 | 3.10 | 3.30 |
| Plates ¼-inch thick | 1.90 | 2.00 | 3.34 | 4.15 | 3.25 | 3.10 | 3.30 |

**WIRE ROPE**—Discounts from list price, f.o.b. New York and east of Missouri River, on regular grades of bright and galvanized are as follows:

| | |
|---|---|
| Cast steel round strand rope | 20% |
| Galvanized steel rigging and guy rope | 7½% |
| Round strand iron and iron-tiller | 5% |
| Plow steel round strand rope | 35% |
| Special steel round strand rope | 30% |
| Galvanized iron rigging and guy rope | +12½% |

| | New York | Cleveland | Chicago |
|---|---|---|---|
| **Drill Rod** (from list) | 60% | 55% | 50% |

**WROUGHT PIPE**—The following discounts are to jobbers for carload lots at Pittsburgh mill:

| | Inches | Steel Black | Steel Galv. | Iron Inches | Iron Black | Iron Galv. |
|---|---|---|---|---|---|---|
| BUTT WELD | 1 to 3 | 62 | 50½ | 1 to 1¼ | 30 | 12 |
| LAP WELD | 2½ to 6 | 59 | 47½ | 3 to 6 | 28 | 13 |

**STEEL PIPE**—From warehouses at the places named the following discounts hold for steel pipe:

| | Black New York | Black Chicago | Black St. Louis |
|---|---|---|---|
| 2½ to 6 in. lap welded | 48% | 51% | 46% |

**CAST-IRON PIPE**—The following are prices per net ton for carload lots:

| | New York Current | New York One Year Ago | Birmingham | Chicago | St. Louis | San Francisco |
|---|---|---|---|---|---|---|
| 6 in. and over | $50.60 | $50.60@52.60 | $39.00 base | $47.20 | $45.60 | $49.00 |

**NUTS**—Semi-finished, ½x½-in., 2c. each. Discount 70% for ⅜-in. and smaller; 65% for ½-in. and larger. Case hardened, 6c. each, less 50%.

**HOLLOW TILE**—Price per block in carload lots to contractor for hollow building tile.

| | New York Current on Trucks | New York One Year Ago | Chicago | Philadelphia | St. Louis | San Francisco | Perth Amboy N. J., Factory |
|---|---|---|---|---|---|---|---|
| 4x12x12 | $0.1027 | $0.1112 | $0.088 | $0.105 | $0.068 | $0.108 | ..... |
| 6x12x12 | .1541 | .1667 | .119 | ..... | .09 | .156 | $0.252* |
| 8x12x12 | .1926 | .2084 | .165 | .205 | .126 | .244 | .312† |

* 10x12x12; † 12x12x12.

**MACHINE BOLTS**—½x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%.

**LUMBER**—Prices of rough Douglas Fir No. 1 common, in carload lots to contractors at yards in San Francisco.

| | 6-8 and 12 Ft. | 10-16-18 and 20 Ft. | 22 and 24 Ft. | 25 to 32 Ft |
|---|---|---|---|---|
| 3x3 and 4 | $26.00 | $27.00 | $28.00 | $31.00 |
| 3x6 and 8 | 26.00 | 27.00 | 28.00 | 31.00 |
| 4x4-6 and 8 | 26.00 | 27.00 | 28.00 | 31.00 |

Wholesale prices to dealers of long leaf yellow pine. To contractors in New York City, delivered from lighters or cars to job, $5 additional.

| | New York 20 Ft. and Under | New York 22-24 Ft. | Chicago Up to 20 Ft., Pine | Chicago Up to 32 Ft., Fir |
|---|---|---|---|---|
| 3x4 to 8x8 | $43.00 | $44.00 | $42.25 | $40.50 |
| 3x10 to 10x10 | 50.00 | 51.00 | 47.00 | 40.50 |
| 3x12 to 12x12 | 57.00 | 58.00 | 57.00 | 40.50 |

| Other Cities | 8 x 8-In. x 20 Ft. and Under Pine | Fir* | Hemlock | Spruce | 12 x 12-In. 20 Ft. and Under Pine | Fir* |
|---|---|---|---|---|---|---|
| Boston | $49.00 | $48.00† | $50.00 | $51.50 | $59.00 | $58.00† |
| Cincinnati | 37.00 | 73.00 | 73.00 | 85.00 | 48.00 | 77.00 |
| Denver | .... | 32.75 | 32.75 | 32.75 | .... | 33.75 |
| Minneapolis | 42.50 | 38.75 | 34.50 | ..... | 45.00 | 38.75 |
| Kansas City, Mo. | 42.50 | 40.75 | ..... | ..... | 57.75 | 40.75 |
| Philadelphia | 54.00 | 38.00 | 38.00 | 45.00 | 65.00 | 38.00 |

*Douglas fir. † Prime.

**NAILS**—The following quotations are per keg from warehouse:

| | Pittsburgh, Mill | Chicago | San Francisco | Dallas | St. Louis | Montreal |
|---|---|---|---|---|---|---|
| Wire | $2.65 | $3.05 | $3.75 | $4.00 | $2.83 | $4.95 |
| Cut | 2.90 | .... | 5.25 | 5.00 | 2.93 | 5.00 |

**PORTLAND CEMENT**—Prices to contractors per bbl. in carload lots *without bags*. Cash discount not deducted.

| | Current | One Month Ago | One Year Ago |
|---|---|---|---|
| NewYork, del. by truck | $2.50@2.60 | $2.50@2.60 | $2.50@2.70 |
| Chicago, f.o.b. | 2.10 | 2.10 | 2.10 |
| Cleveland, f.o.b. | 2.29 | 2.29 | 2.29 |

**LIME**—Warehouse prices, New York quotes 280 lb. net; Chicago, 180 lb.:

| | Hydrated, per Ton Finishing | Hydrated, per Ton Common | Lump, per Barrel Finishing | Lump, per Barrel Common |
|---|---|---|---|---|
| New York | $18.20 | $11.00 | $3.50 | $2.10@$3.00 |
| Chicago | 20.00 | 18.00 | .... | 1.50 |

**LINSEED OIL**—These prices are per gallon:

| | New York Current | New York One Year Ago | Chicago Current | Chicago One Year Ago |
|---|---|---|---|---|
| Raw in barrel (5 bbl. lots) | $0.84½ | $0.99 | $0.84 | $0.99 |

**WHITE AND RED LEAD**—In 100-lb. kegs, base price in cents per pound:

| | Dry Current | Dry 1 Yr. Ago | In Oil Current | In Oil 1 Yr. Ago |
|---|---|---|---|---|
| Red | 15.25 | 15.25 | 16.75 | 16.75 |
| White | 15.25 | 15.25 | 15.25 | 15.25 |

**HOSE**—Quotations at New York warehouses:

Fire Protection 50-Ft. Lengths
Underwriters' 2½-in. coupled, single jacket (net) ..... $0.68 per ft.

Air—Best Grade
¾-in., per ft. ..... 3 ply $0.34 4 ply ..... $0.42

Steam—Discounts from List
First grade ... 40% Second grade ..... 40–5% Third grade ..... 50%

**RUBBER BELTING**—List price 6-in., 6 ply, $1.83 per lin.ft. for rubber transmission belting.
Best grade ..... 50% Second grade ..... 50-10%

**LEATHER BELTING**—List price, 24c. per lin.ft. per inch of width for single ply at New York warehouses:

| Grade | Discount from list |
|---|---|
| Medium | 40–5% |
| Heavy | 30–10% |

**RAWHIDE LACING**
For cut, best grade, 50%, 2nd grade, 60%.
For laces in sides, best, 41c. per sq.ft.; 2nd, 37c.
Semi-tanned: cut, 50%; sides, 41c. per sq.ft.

**PACKING**—Prices per pound:

| | |
|---|---|
| Rubber and duck for low-pressure steam, ½ in. | $1.05 |
| Rubber sheet | .60 |
| Rubber sheet, wire insertion | .85 |

**MANILA ROPE**—Per lb., ¾-in. and larger, 1,200-ft. coils.

| | | | |
|---|---|---|---|
| Atlanta | $0.30 | New Orleans | $0.21 |
| New York | .23 | Seattle | .22 |
| Chicago | 22½ | San Francisco | .22 |

**EXPLOSIVES**—Prices per pound of dynamite in small lots:

| | Gelatin 40% | Gelatin 60% |
|---|---|---|
| New York | $0.265 | $0.2875 |
| Minneapolis | .1917 | .2123 |
| Denver | .2025 | .2275 |
| Seattle | .165 | .19 |
| Cincinnati | .22 | .245 |
| New Orleans | .235 | .26 |
| San Francisco | .1625 | .1925 |

**FLOTATION OIL**—
Pine tar, 50 gal. bbl., gross weight 500 lb., f.o.b. New York, carload lots, per gal. ..... $0.46

**CHEMICALS**—

| | |
|---|---|
| Zinc dust, 550 lb. casks, f.o.b. works, per lb. | $0.09½@.16 |
| Litharge, casks, f.o.b. works, per lb. | .11 |
| Sodium cyanide, 220 lb. single case lots, f.o.b. works, per lb. | 18@.22 |
| Calcium carbide, in drums, f.o.b. works, per lb. | .05½@.06 |

# Mining Stocks—Week Ended December 18, 1926

| Stock | Exch. | High | Low | Last | Last Div. |
|---|---|---|---|---|---|
| **COPPER** | | | | | |
| Anaconda | New York | 49½ | 48 | 48½ | Oc.16, No.22 Q 0.75 |
| Arcadian Consol. | Boston | *70 | *70 | *70 | ..... |
| Ariz. Com'l. | Boston | 10½ | 10 | 10 | Jy. 16, Jy. 30 0.50 |
| Calaveras | N. Y. Curb | .... | .... | 1½ | ..... |
| Calumet & Arizona | New York | 69½ | 67½ | 68½ | De. 3, De. 20Q 1.50 |
| Calumet & Hecla | Boston | 16 | 15⅝ | 15⅝ | No.30, De.15 0.50 |
| Cerro de Pasco | New York | 65⅛ | 63⅛ | 63⅜ | De.16,De.23,X 1.00 |
| Chile Copper | New York | 36¼ | 34½ | 35 | De.1,De.27, Q 0.62½ |
| Chino | New York | .... | .... | 25⅛ | ..... |
| Con. Coppermines | N. Y. Curb | 3⅛ | 3 | 3 | ..... |
| Copper Range | Boston | 15⅜ | 14 | 15⅛ | May, 1925 1.00 |
| Crystal Copper | Boston Curb | *30 | *30 | *30 | ..... |
| East Butte | Boston | 2½ | 2¼ | 2⅜ | Dec., 1919 0.50 |
| First National | Boston Curb | *5 | *5 | *5 | Feb., 1919 0.15 |
| Franklin | Boston | .... | .... | *30 | ..... |
| Granby Consol. | New York | 36⅛ | 35 | 35⅜ | May, 1919 1.25 |
| Greene-Cananea | New York | 14¾ | 31⅜ | 33⅞ | Nov., 1920 0.50 |
| Hancock | Boston | *50 | *50 | *50 | ..... |
| Howe Sound | New York | 41⅜ | 40 | 40½ | Oc.1, Oc.15 Q 1.00 |
| Inspiration Consl. | New York | 27⅛ | 26 | 26⅛ | De.16, Ja.3, Q 0.50 |
| Iron Cap | Boston Curb | 4⅞ | 4½ | 4¼ | ..... |
| Isle Royale | Boston | 11 | 10⅞ | 11 | No. 30, De. 15 0.50 |
| Jerome Verde Dev. | N. Y. Curb | *30 | *25 | *30 | ..... |
| Kennecott | New York | 63⅜ | 62⅜ | 62⅝ | De. 3, Ja 2 Q 1.25 |
| Lake Copper | Boston | 1 | *95 | 1 | June, 1925 0.50 |
| Magma Copper | New York | 36½ | 35⅝ | 35⅝ | Dec.1, Ja.15,Q 0.75 |
| Mason Valley | N. Y. Curb | 2⅝ | 2¼ | 2½ | ..... |
| Mass Consolidated | Boston | *35 | *27 | *30 | Nov., 1917 1.00 |
| Miami Copper | New York | 16⅜ | 16⅛ | 16⅛ | No.1, No. 15 Q 0.37½ |
| Mohawk | Boston | 41⅜ | 40 | 40⅛ | Oc.30, De 1 Q 2.00 |
| Mother Lode Coa. | New York | 4⅜ | 4¼ | 4⅛ | De.10,De.31 SA 0.37½ |
| Nevada Consol. | New York | 16⅛ | 15¾ | 15⅜ | De.15, De.31Q 0.37½ |
| New Cornelia | Boston | 22⅜ | 22⅛ | 22⅜ | No.5, No.22 Q 0.50 |
| Noranda | N. Y. Curb | 23⅜ | 22¼ | 23 | ..... |
| North Butte | Boston | 3⅜ | 2⅝ | 3⅜ | Oct., 1918 0.25 |
| Ohio Copper | N. Y. Curb | *60 | *45 | *60 | Se. 1, Se. 15 0.05 |
| Old Dominion | Boston | 15 | 14⅛ | 14⅛ | Dec., 1918 1.00 |
| Phelps Dodge | Open Mar. | †135 | †131 | .... | Se.25, Oc.2 Q 1.50 |
| Quincy | Boston | 18 | 17⅛ | 17⅛ | Mar., 1926 1.00 |
| Ray Consolidated | New York | 16⅞ | 16 | 16 | Ap.20, Ap.30 0.25 |
| Ray Hercules | N. Y. Curb | .... | .... | 16⅛ | ..... |
| St. Mary's Min. Ld. | Boston | 26⅛ | 26¼ | 26⅛ | Ap.17, My.18 2.00 |
| Seneca Copper | New York | 3¼ | 3 | 3⅜ | ..... |
| Shannon | Boston | *30 | *26 | *30 | Nov., 1917 0.25 |
| Shattuck-Denn | Boston Curb | 6⅛ | 5⅞ | 5⅞ | ..... |
| Superior & Boston | Boston | *26 | *20 | *20 | ..... |
| Tenn. C. & C. | New York | 11⅛ | 10⅞ | 10⅞ | No.30, De.15, Q 0.25 |
| United Verde Ex. | N. Y. Curb | 24⅜ | 24 | 24⅛ | Ja. 6, Fe. 1 0.75 |
| Utah Copper | New York | 111 | 111 | 111 | De.15,De.31 Q 1.50 |
| Utah Metal & T. | Boston | 1 1/16 | 1⅛ | 1⅛ | Dec., 1917 0.30 |
| Victoria | Boston | *70 | *65 | *70 | ..... |
| Walker Mining | Salt Lake | *80 | *75 | *76 | ..... |
| **NICKEL-COPPER** | | | | | |
| Internat. Nickel | New York | 38⅞ | 37½ | 37⅝ | De.16, De.31,Q 0.50 |
| Internat. Nickel, pfd. | New York | ... | ... | 103½ | Oc. 14, No.1, 1.50 |
| **LEAD** | | | | | |
| Gladstone Mtn. | Spokane | *30 | *29½ | *30 | Dec. 10, 1926 0.005 |
| National Lead | New York | 181 | 167 | 178 | De.10, De 31 Q 2.00 |
| National Lead pfd. | New York | 118 | 117½ | 118 | No.19,De.15 Q 1.75 |
| St. Joseph Lead | New York | 41⅞ | 40¾ | 41 | Ma.10, 21 XQ 0.75 |
| **ZINC** | | | | | |
| Am. Z. L. & S. | New York | 10½ | 7⅞ | 8⅛ | May., 1917 1.00 |
| Am. Z. L. & S, pfd. | New York | 51⅛ | 46½ | 47 | Nov., 1920 1.50 |
| Butte C. & Z. | New York | 4⅜ | 4⅛ | 4⅜ | De.9, De.24 0.50 |
| Butte & Superior | New York | 13 | 10⅜ | 11⅜ | De.9, De.24 Q 0.50 |
| Callahan Zinc-Ld. | New York | 1⅜ | 1⅛ | 1⅜ | Dec., 1920 0.50 |
| Eagle-Picher | Cincinnati | 29¼ | 27⅞ | 28 | No.15, De.1 Q 0.40 |
| Eagle-Picher, pfd. | Cincinnati | .... | .... | 100 | Se. 30, Oc. 5 Q 1.50 |
| New Jersey Zn. | N. Y. Curb | 187½ | 185 | 187½ | No.20, De.10 X 2.00 |
| United Zinc | N. Y. Curb | .... | .... | *70 | ..... |
| Yellow Pine | Los Angeles | *17 | *15 | *17 | Dec. 1925 Q 0.04 |
| **GOLD** | | | | | |
| Alaska Juneau | New York | 1⅝ | 1⅜ | 1⅜ | ..... |
| Argonaut | Toronto | *57½ | *44½ | *50½ | ..... |
| Barry-Hollinger | Toronto | *87½ | *83 | *84 | ..... |
| Carson Hill | Boston | *20 | *20 | *20 | ..... |
| Consol. W. Dome L. | Toronto | *22½ | *21 | *21 | ..... |
| Cresson Consol. G. | N. Y. Curb | 2⅝ | 2⅜ | 2⅜ | De.31, Ja.10 Q 0.10 |
| Crown Reserve | Toronto | *9⅜ | *8⅜ | *9 | Jan., 1917 0.05 |
| Dome Mines | New York | 12⅜ | 11½ | 12⅜ | De.31, Ja.20, Q 0.50 |
| Golden Center | N. Y. Curb | *8 | *8 | *8 | ..... |
| Golden Cycle | Colo Spring | .... | .... | 1.74 | No.30, De.10 Q 0.04 |
| Hollinger Consol. | Toronto | 19.90 | 19.00 | 19.65 | De.13, De.31F 0.10 |
| Homestake Mining | New York | ... | ... | 62½ | De.20,De.27 M 0.50 |
| Kirkland Lake | Toronto | *75 | *70 | *73 | ..... |
| Lake Shore | Toronto | 15.10 | 14.50 | 15.00 | De.2,De.15 X 0.20 |
| McIntyre-Porcupine | New York | 26 | 25 | 26 | No.1, De.1 Q 0.25 |
| Newray | Toronto | .... | .... | *38½ | ..... |
| Night Hawk Pen. | Toronto | *8½ | *4½ | *8 | ..... |
| Portland | N. Y. Curb | .... | .... | 43 | Ja.6, Ja.15, '27 0.02 |
| Rand Mines | New York | 37⅜ | 37⅜ | 37⅜ | Au.23-30Am.Sh. 1.52 |
| Teck-Hughes | Toronto | 5.05 | 4.80 | 5.04 | Jy. 15, Au. 2 0.05 |
| Tom Reed | Los Angeles | *45 | *45 | *45 | Dec., 1926 0.02 |
| Tough-Oakes | Toronto | *57 | *53 | *56½ | ..... |
| United Eastern | N. Y. Curb | *57 | *50 | *57 | July, 1924 0.05 |
| Vipond Cons. | Toronto | 1.73 | 1.59 | 1.65 | ..... |
| Wright-Hargreaves | Toronto | 9.50 | 8.99 | 9.48 | Se.15, Oc.1 QX 0.07½ |
| Yukon-Alaska Trust | N. Y. Curb | ... | ... | 20⅛ | ..... |
| **GOLD AND SILVER** | | | | | |
| Carnegie Metals | Boston | 12 | 11⅛ | 11⅛ | ..... |
| Con. Cortez | N. Y. Curb | .... | .... | *4 | ..... |
| Con. Virginia | San Francisco | *7½ | *6½ | *6½ | ..... |
| Continental Mines | N. Y. Curb | *15 | *10 | *10 | ..... |
| Dolores Esperanza | N. Y. Curb | *55 | *50 | *50 | July, 1923 0.05 |
| Premier Gold | N. Y. Curb | 2 | 1 15/16 | 1 15/16 | De.7, Ja.4 0.08 |
| Tonopah Belmont | N. Y. Curb | 2⅛ | 2⅛ | 2⅛ | Se.15, Oc.1 0.05 |
| Tonopah Extension | N. Y. Curb | *18 | *18 | *18 | Apr. 1925 0.05 |
| Tonopah Mining | N. Y. Curb | 3⅜ | 3⅜ | 3⅜ | Se.30, Oc.27 SA 0.07½ |
| Unity Gold | N. Y. Curb | .... | .... | *30 | ..... |
| West End Consol. | N. Y. Curb | *9 | *9 | *9 | Mar., 1923 0.05 |
| Yukon Gold | N. Y. Curb | .... | .... | *42 | June, 1918 0.02 |

| Stock | Exch. | High | Low | Last | Last Div. |
|---|---|---|---|---|---|
| **SILVER** | | | | | |
| Alvarado | N. Y. Curb | .... | .... | 1 | Oct., 1920 0.50 |
| Beaver Consol. | Toronto | *56 | *54 | *54 | May. 1920 0.03 |
| Canadian Lorrain. | Toronto | *61 | *59 | *60 | ..... |
| Castle-Trethewey | Toronto | 1.12 | 1.08 | 1.08 | ..... |
| Comagas | Toronto | 4.49 | 4.20 | 4.49 | May, 1924 0.12½ |
| Keeley | Toronto | 1.55 | 1.50 | 1.53 | Se.1, Se.15 SA 0.12 |
| Kerr Lake | N. Y. Curb | *75 | *75 | *75 | Oc.1, Oc.15 SA 0.12½ |
| La Rose | Toronto | *16 | *9½ | *15 | Apr., 1922 0.10½ |
| Lorrain Trout Lake | Toronto | .... | .... | *55 | Jy. 2, Jy. 15 0.05 |
| McKinley-Dar.-Sav. | Toronto | *14 | *12 | *13½ | Oct., 1920 0.03 |
| Mining Corp. Can. | Toronto | 3.80 | 2.77 | 3.45 | De.30, Ja.15 0.12½ |
| Nipissing | N. Y. Curb | 9⅛ | 6⅞ | 8⅝ | De.31, Ja.20 Q 0.15 |
| Temiskaming | Toronto | *7⅛ | *7⅛ | *7⅛ | Jan., 1920 0.40 |
| **SILVER-LEAD** | | | | | |
| Ahumada | New York | 5⅛ | 5 | 5 | De.18,Ja 5, QX 0.15 |
| Alta Merger | Salt Lake | †*4 | †*2 | .... | ..... |
| Bingham Mines | Boston | 35 | 32⅛ | 34½ | De.30, Ja 5 Q 1.00 |
| Cardiff M. & M. | Salt Lake | *24½ | *22 | *24½ | Nov., 1924 0.10 |
| Chief Consol. | Salt Lake | .... | .... | 3.00 | Oc.10, No.1 Q 0.10 |
| Consti'n Mng.&Mill'g | Spokane | *54 | *48 | *50 | ..... |
| Emma Silver | Salt Lake | †1½ | †1 | .... | ..... |
| Erupcion | Boston Curb | 1⅛ | 1 1/16 | 1⅛ | De.18, Ja.3, Q 0.10 |
| Federal M. & S. | New York | 94⅜ | 94 | 94 | ..... |
| Federal M. & S., pfd. | New York | 81 | 75 | 76 | No.24, De.15 Q 1.75 |
| Hawthorne Mines | N. Y. Curb | *11 | *7 | *11 | ..... |
| Hecla Mining | N. Y. Curb | *16 | *15⅞ | *16 | No.15,De.15 Q 0.50 |
| Highland-Surprise | Spokane | *20 | *18 | *19 | ..... |
| Iron King Mining | Salt Lake | *20 | *20⅛ | *20⅛ | ..... |
| Keystone Mining | Salt Lake | *30 | *30 | *30 | Au.12, Au.26 0.07½ |
| Lucky Jim | Spokane | *15¼ | *14½ | *15½ | ..... |
| Lucky Tiger-Com. | Kansas City | †6.50 | †6.20 | .... | Dec. 20, 1926 0.12 |
| Mammoth Mining | Salt Lake | 3.00 | 2.65 | 2.65 | Apr. 1, 1926 0.10 |
| Marsh Mines | Spokane | 1⅞ | 1⅞ | 1⅞ | Se.15, Oc.19 0.15 |
| Park Utah | New York | 6.10 | 5.75 | 5.80 | De.15, Ja.2 Q 0.15 |
| Plutus Mining | Salt Lake | 2.17½ | 2.15 | 2.17½ | Oct. 15, Q 0.15 |
| Prince Cons. | Salt Lake | *3 | *2½ | *2½ | ..... |
| Silver King Coal | Salt Lake | 8.10 | 7.60 | 7.60 | De. 16, Ja.3, 0.25 |
| Silversmith | Spokane | *25⅜ | *25 | *25 | Oc.1, Oc.10 Q 0.02 |
| Strattons Mines | Spokane | *32½ | *30 | *30 | ..... |
| Sunshine M. Co. | Spokane | *37 | *36 | *36 | ..... |
| Tamarack-Custer | Spokane | *44 | *38½ | *41½ | Sept., 1924 0.25 |
| Tintic Standard | Salt Lake | 10.50 | 10.00 | 10.00 | De.11, Ja.3 0.30 |
| Utah-Apex | Boston | 5¼ | 5 | 5⅛ | Oc.3, Oc.15 Q 0.25 |
| Western Utah Copper | N. Y. Curb | .... | .... | *5 | ..... |
| **IRON** | | | | | |
| Bethlehem Steel | New York | 48¼ | 46¼ | 48 | July, 1924 1.25 |
| Cleveland-Cliffs Iron | Cleveland | 78 | 70 | 77 | Oct., 1926 1.00 |
| Colorado Fuel & Iron | New York | 46¾ | 44 | 46 | May, 1921 0.75 |
| Gt. North'n Iron Ore | New York | 18⅜ | 18⅛ | 18⅛ | Dec.6, Dec.28 0.75 |
| Inland Steel | New York | 41⅜ | 39 | 41⅛ | No.15, De.1 Q 0.62½ |
| Mesabi Iron | N. Y. Curb | 96 | 91 | 96 | ..... |
| Replogle Steel | New York | 12⅜ | 11 | 11⅜ | ..... |
| Republic I. & S. | New York | 58⅜ | 56 | 57½ | No.15, De.1 Q 1.00 |
| Republic I. & S. pfd. | New York | 98⅛ | 96½ | 96½ | De.15, Ja.2 Q 1.75 |
| Sloss-Sheffield S. & I. | New York | 133 | 128 | 130 | De.10, De.20 Q 1.50 |
| Sloss-Shef. S.&I. pfd. | New York | .... | .... | 107 | De.20, Ja.3 Q 1.75 |
| U. S. Steel | New York | 160½ | 150½ | 159⅛ | De.1, De.30 Q 1.75 |
| U. S. Steel pfd. | New York | 129½ | 128¼ | 129 | No.2, No.29,Q 1 75½ |
| Virginia I. C. & C. | New York | ... | ... | 50 | Jan., 1924 1.50 |
| Virginia I.C.&C.pfd | New York | 85 | 85 | 85 | De.15, Ja.2, 2.50 |
| **DIAMONDS, PLATINUM, ALUMINUM, VANADIUM** | | | | | |
| De Beers Consol | New York | ... | ... | 33½ | Ju.16, Ju.17 1.70 |
| So. Am. Gold & P. | N. Y. Curb | 3¾ | 3 | 3¾ | ..... |
| Alum.Co.of Amer. | N.Y.Curb | 72 | 70½ | 72 | ..... |
| Alum. Co. of Amerpf. | N.Y.Curb | 102½ | 102½ | 102½ | De.15, Ja.15 Q 1.50 |
| Vanadium Corp. | New York | 40⅜ | 38¼ | 39 | De.1, De.15, X 1.00 |
| **ASBESTOS** | | | | | |
| Asbestos Corp., New | Montreal | 24½ | 23½ | 24½ | Jan., 1926 1.50 |
| Asbestos Corp., pfd. | Montreal | 87 | 82⅝ | 87 | De.31, Ja.15, Q 1.75 |
| **SULPHUR** | | | | | |
| Freeport Texas | New York | 34½ | 32½ | 32⅞ | Ja.15, Fe.1 Q 0.50 |
| Texas Gulf, new | New York | 50½ | 47⅜ | 47⅞ | De.1, De.15, Q 1.00 |
| **MINING, SMELTING, REFINING AND GENERAL** | | | | | |
| Amer. Metal | New York | 45⅝ | 44½ | 45 | No.19, De. 1, Q 1.00 |
| Amer. Metal pfd. | New York | .... | .... | 113⅞ | No.20, De.1 Q 1.75 |
| Amer. Sm. & Ref. | New York | 146½ | 139½ | 145¼ | Oc.15, No.1, Q 2.00 |
| Amer. Sm.&Ref.pfd. | New York | 122 | 121 | 122 | No.5, De.1, Q 1.75 |
| Consol. M. & S. | N. Y. Curb | .... | .... | 300 | De.31, Ja.15 X 6.25 |
| Federated Metals | N. Y. Curb | 12⅝ | 12⅛ | 12⅛ | ..... |
| Newmont Mining | N. Y. Curb | 74 | 73 | 74 | Oc.1, Oc.15, Q 0.60 |
| Southwest Metals | N. Y. Curb | ... | ... | *90 | ..... |
| U. S. Sm. R. & M. | New York | 37⅛ | 36½ | 37 | Oc.7, Oc.15, Q 0.87½ |
| U. S. Sm. R.&M.pfd. | New York | 46¼ | 46¼ | 46½ | Oc.7, Oc.15, Q 0.87½ |

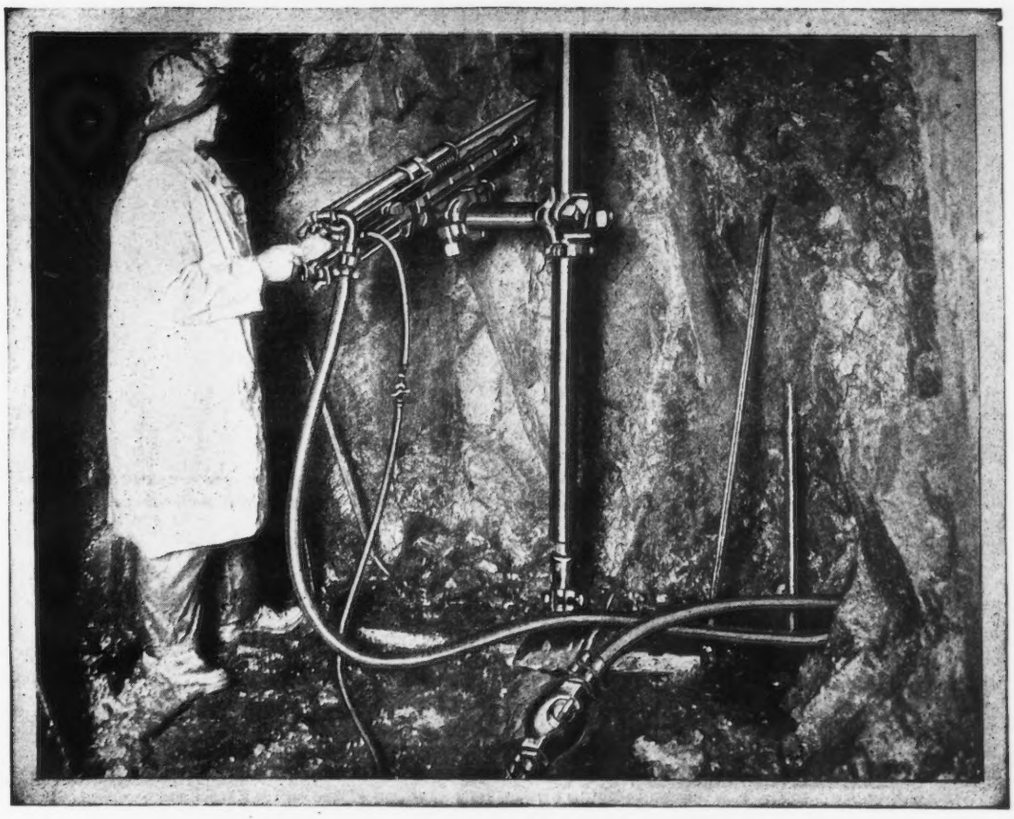
* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. F, four weeks. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Henry Sachs, Colorado Springs, Colo.

## LONDON QUOTATIONS—WEEK ENDED DEC. 8, 1926

| Name | High | Low | Last | Last Divd Date | Amount |
|---|---|---|---|---|---|
| Aramayo Mines (25 frs.) | 76/10½ | 72/6 | 75/— | Aug. 1926 | 15 p.c.† |
| British Platinum (£1) | 3/6 | 3/3 | 3/6 | Feb. 1925 | 2½ p.c. |
| Burma Corpn. (10 rupees) | 14/7½ | 13/10½ | 14/1½ | Aug. 1926 | 7 annas* |
| Bwana M'Kubwa (5s) | 7/1½ | 6/9 | 7/— | | |
| Camp Bird (2s) | 3/3 | 2/1½ | 2/3 | | |
| El Ore (£1) | 5/7½ | 5/— | 5/— | Nov. 1924 | 2½ p.c.* |
| Esperansa (10s) | —/6 | —/5 | —/6 | | |
| Frontino & Bolivia (£1) | 10/— | 8/9 | 10/— | Jan. 1927 | 5 p.c. |
| Mexican Corpn. (£1) | 9/— | 8/— | 8/3 | | |
| Mexico Mines of El Oro (£1) | 20/9 | 20/— | 20/— | Dec. 1926 | 3½ p.c.* |
| Oroville Dredging (£1) | 3/6 | 3/1½ | 3/6 | Dec. 1923 | 3¼ p.c. |
| Ouro Preto (£1) | 2/1½ | 2 — | 2/— | May 1925 | 2½ p.c. |
| Rhodesian Congo Border (£1) | 83/9 | 75/— | 75/— | | |
| St. John del Rey (£1) | 9/6 | 8/10½ | 9/— | June 1925 | 6½ p.c. |
| San Francisco Mines (10s) | 31/9 | 29/9 | 31/6 | June 1926 | 15 p.c. |
| Santa Gertrudis (£1) | 14/9 | 13/— | 14/6 | Jan. 1927 | 3½ p.c. |
| Selukwe (2s. 6d.) | 11/7½ | 10/9 | 11/3 | April 1917 | 6¼ p.c. |
| S. Amer. Copper (2s.) | 3/6 | 3/2 | 3/6 | Nov. 1917 | 75 p.c. |
| Tanganyika (£1) | 45/3 | 38/— | 42/6 | Aug. 1926 | 7½ p.c. |
| Tomboy (£1) | 3/6 | 3/— | 3/6 | July 1926 | 10 p.c. |
| Union Miniere du Haut-Katanga (Brussels) | 8.200 | 8.000 | 8.050 | July 1926 | 170 (‡) |

* Free of British income tax. † Swiss frs. ‡ Belgian frs. and free of taxation.



*Model 7 in a Utah Silver Mine. Showing Line Oiler Attached*

# *Waugh "Seven" Drifter*

There are several reasons for the rapid and widespread popularity of this machine.

Most of the installations to date were made only after a "brass tacks" demonstration of its speed, power and reliability.

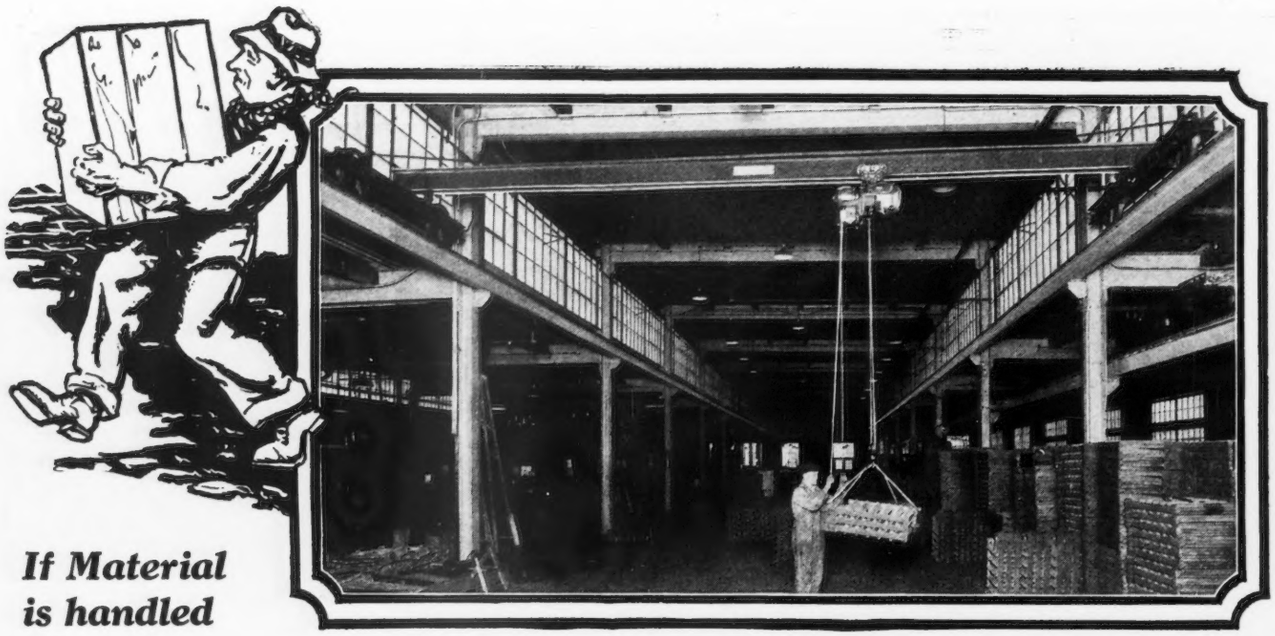
On these three points, plus ease of handling and perfect Line Oiler lubrication, it is winning recognition for unquestioned superiority.

For excessively hard formations, or for high speed tunnel driving, the Model 17 (which is a larger Model 7) is recommended.

## THE DENVER ROCK DRILL MANUFACTURING COMPANY

**DENVER COLORADO**

*Branch Offices and Stocks in All Important Centers*



***If Material is handled like this in your plant — —***

# Get a "C-M" Idea!

IF the transportation of material in your plant is left to the physical ability of men to lift and carry, your costs are higher than they need be.

In the plant illustrated in the view above, *ONE* man with a "C-M" Electric Hoist and Traveling Crane moves more material with less effort than *FOUR or MORE* men could possibly do by physical effort.

***Moving should not be 90% of Making!***

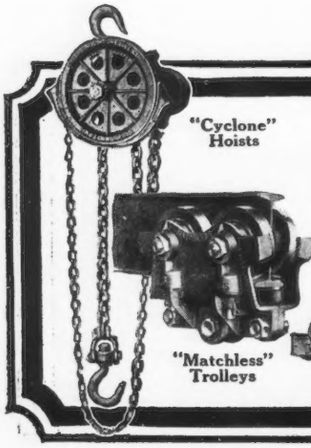
## Results

ONE MAN doing the work of FOUR or MORE, thereby releasing three or more men for other work! Faster handling of material; Rock bottom handling costs; And valuable floor space saved because of the ability of the "C-M" equipment to stack material higher than could be done by the combined strength of a gang of men.

*Put "C-M" Ideas to work in your plant!*

# CHISHOLM-MOORE

OVERHEAD HOISTS CRANES TROLLEYS TRACK SYSTEMS



"Cyclone" Hoists

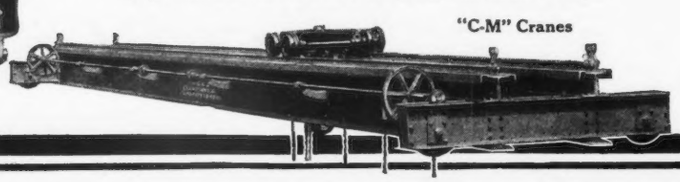
"Matchless" Trolleys

"C-M" is the trademark of a complete line of Overhead Material-Handling Equipment backed by an organization ably qualified to apply that equipment correctly to thousands of material-handling conditions. "C-M" Engineering Service is gratis. The "C-M" policy is based on "*Facts* to show YOU the way to MORE PROFIT!" Write for particulars.

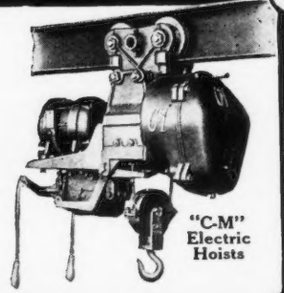
THE CHISHOLM-MOORE MFG. CO., Cleveland, Ohio

*Branches:* New York, Chicago, Pittsburgh

*Representatives in All Territories for Immediate Service*



"C-M" Cranes



"C-M" Electric Hoists

# WILLIAMSPORT WIRE ROPE

TELFAX TAPE MARKED
FACTORY CERTIFIED

**is standard equipment on**

## Keystone Drillers and Excavators

**This message is broadcast to 1,368,000 people using wire rope because it deserves to be.**

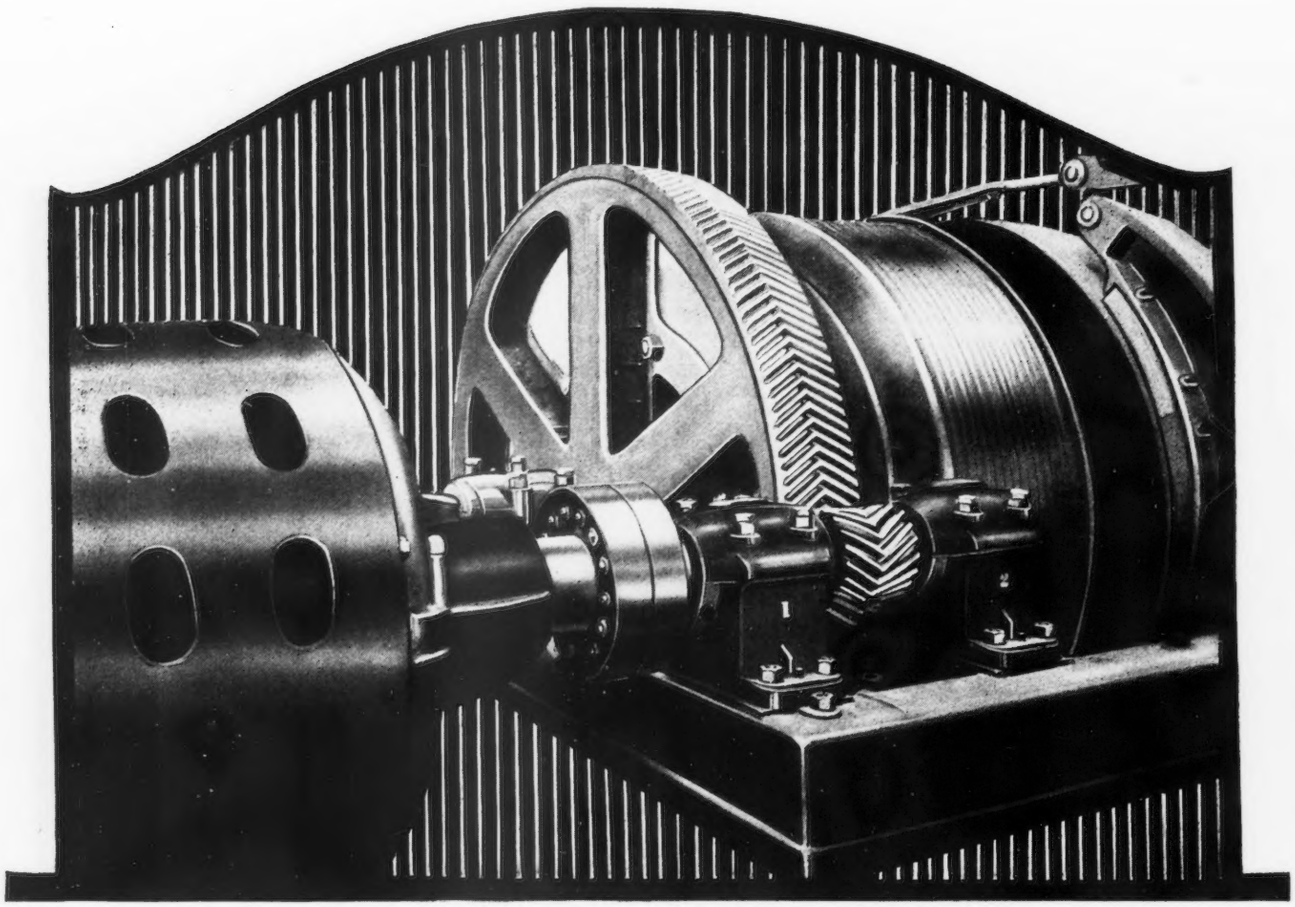
You men who risk your lives with ponderous machinery are entitled to the protection you get in the use of Williamsport Wire Rope and a manufacturer who thus equips his machinery is thinking more of your safety than the price he pays. He believes in safeguarding you in every way available and Williamsport is the only wire rope made, all grades of which is marked with plain English proof. Such manufacturers deserve your confidence. You have a right to be nervous about the tensile strength of ropes not so marked—The Good name of any manufacturer is not a protection against mistakes—but the wrong grade of Williamsport Wire Ropes can be instantly detected by anyone. Others can not.

**Isn't this protection worth demanding—If you think so, insist upon Williamsport equipment on the machines you are using, for your own protection.**

**WILLIAMSPORT WIRE ROPE COMPANY**

**Main Office and Works:**
**WILLIAMSPORT, PENNA.**

**General Sales Offices:**
**Peoples Gas Bldg., CHICAGO**



# *Responsible Gears Should Have a BACKBONE*

THERE'S NO GAP at the center of Sykes Generated Double Helical Gears with Continuous Teeth. The construction of teeth without the gap gives greater strength, reduces possibility of breakage and permits greater load carrying capacity. The backbone of a Farrell-Sykes gear is an additional factor of safety. The teeth have no under cut and have full bearing surface.

Here is a splendid example of the modern mine hoist equipped with the most advanced type of gear. This photograph shows an Ottumwa hoist equipped with a Farrell-Sykes gear—a gear highly desirable for hoists, pumps, fans, mills, crushers and other mining machinery.

A maximum helical angle of 23 degrees is no longer a limitation, as Sykes gears are cut at an angle of 30 degrees as standard. This secures extraordinary power economy.

Our engineers will be pleased to be consulted on any gear transmission matter, and will suggest the most suitable and efficient type of gear for your particular requirement.

## FARREL FOUNDRY & MACHINE CO.

BUFFALO, N. Y., U. S. A.

New York, N. Y., 19 Wall St.
Boston, Mass., 914 Little Bldg.
Cleveland, Ohio, 802 Swetland Bldg.
Pittsburgh, Pa., 649 Union Trust Bldg.
San Juan, Porto Rico
Havana, Cuba, Edificio, Canada
Mexico City, Mexico, 215 Cidosa Bldg.

PLANTS LOCATED AT BUFFALO, N. Y. AND ANSONIA, CONN.

*The Gear with* FARREL SYKES GEARS *a Backbone*

# 2500 feet in one straight high lift

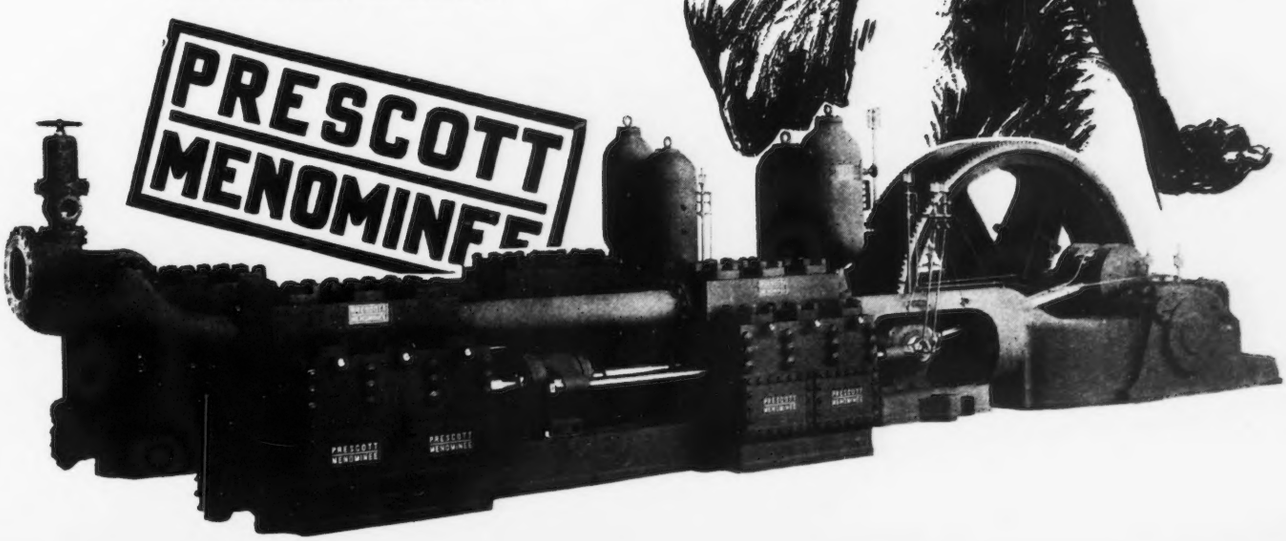
MINE shafts are going deeper every day and whereas a few years ago deep mines were rare, today 2,000, 2,500 feet and even deeper shafts are common.

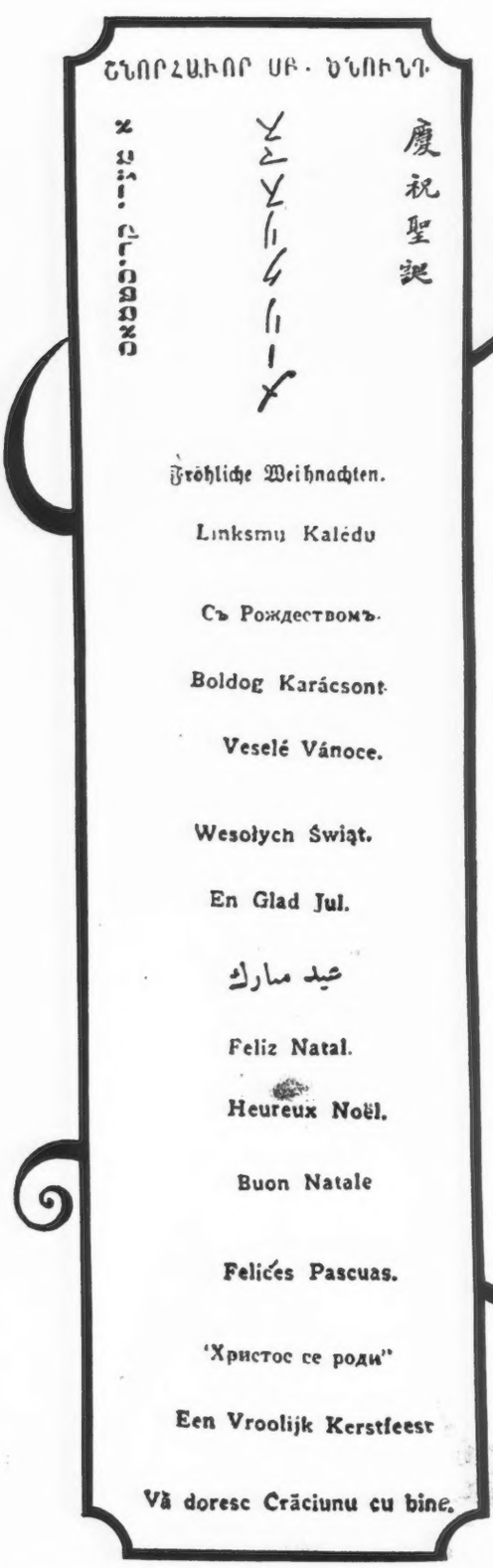
In the design and construction of Prescott-Menominee Mine Pumps, this tendency has been foreseen and provided for. Prescott-Menominee Pumps are *built* to handle large volumes of water, pumping against very high heads. They make the single-lift pumping principle possible for practically any mine.

Large Prescott-Menominee pumping units are handling water in a single lift from depths as great as 2,500 feet, and from shallower levels in quantities as large as 5,000 gallons per minute. The largest underground installation of pumps in the world for high pressures is a Prescott-Menominee installation.

Prescott-Menominees are designed to embody *dependable* service. Write us regarding your pumping problems.

THE PRESCOTT COMPANY
*Fred. M. Prescott, President*
MENOMINEE, MICHIGAN






*in other words*

# A MERRY CHRISTMAS

to users of

# TRAYLOR PRODUCTS

(and everybody else)

## the world over

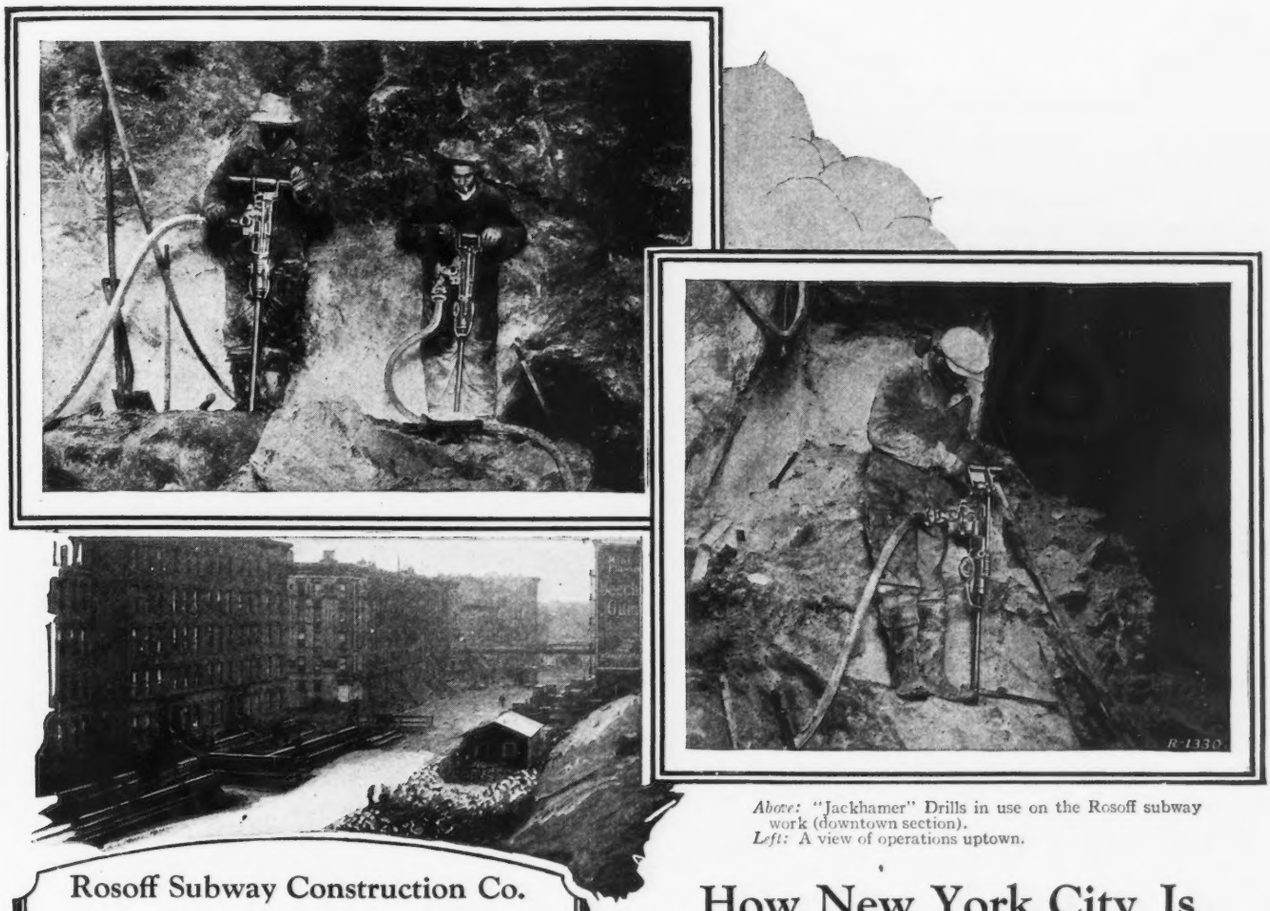
TRAYLOR ENGINEERING & MANUFACTURING CO., Allentown, Pa.

| New York City | Chicago | Los Angeles | Seattle | Salt Lake City |
|---|---|---|---|---|
| 30 Church St. | 1414 Fisher Bldg. | 362 I. W. Hellman Bldg. | 815 Alaska Bldg. | 101 W. 2nd So. St. |

Export Department—104 Pearl St., New York City

Foreign Sales Agencies: London, Rangoon, Lima, Rio de Janeiro, Sao Paulo, Buenos Aires, Santiago, Valpariaso, Antofagasta, Iquique, Oruro.

European Works—Usines Carels Freres, Ghent, Belgium.



*Above:* "Jackhamer" Drills in use on the Rosoff subway work (downtown section).
*Left:* A view of operations uptown.

## Rosoff Subway Construction Co.

***History:*** The Rosoff Subway Construction Company was organized and built up by Mr. S. R. Rosoff, who has been active in all types of construction work for about twenty-five years.

One of his first big jobs was the delivery of the rip-rap and stone for the Degnan Contracting Co., during the building of the Cape Cod Canal. This was followed by many important contracts in and about New York City, of which the following are probably the best-known:

The demolition of several buildings formerly on the site of the new court house.
The construction of a large and well-equipped pier at Long Branch, N. J.
The disposition of City refuse at Riker's island—a contract which saved New York many thousands of dollars.
Numerous sections of concrete and asphalt road throughout New York State.

The Rosoff Company is at present busy on two big subway jobs—Route 78, Section 3-A, and Route 102, Section 3. These two jobs were awarded on net bids of $4,689,775 and $5,886,506 respectively.

***Personnel:*** S. R. Rosoff, Pres.; Arthur H. Diamant, Vice-Pres.; Harry C. Sanford, Chief Engineer; Dan McLean and J. Fisher, Superintendents.

*(This is the nineteenth of a series on the New York Subway Contractors.)*

# How New York City Is Building 10 Miles of New Subways

Without its rock foundation, New York City could never have built the massive towers and office buildings which form its modern "sky-line."

But the very rock that forms a natural foundation for thousands of skyscrapers and industrial plants is also the most serious obstacle in the path of the subway builders. They spend months, even years, burrowing through the ground on a construction project that would seem impossible to all but the best of engineers.

Even today, New York would have no subways without the power and punch of the pneumatic rock drill. Work that 30 men once took a day to perform can now be done by a single driller and an air-operated "Jackhamer."

In this instance, as in a hundred others, Ingersoll-Rand Company has enlisted the aid of compressed air in the elimination of wasted time and effort.

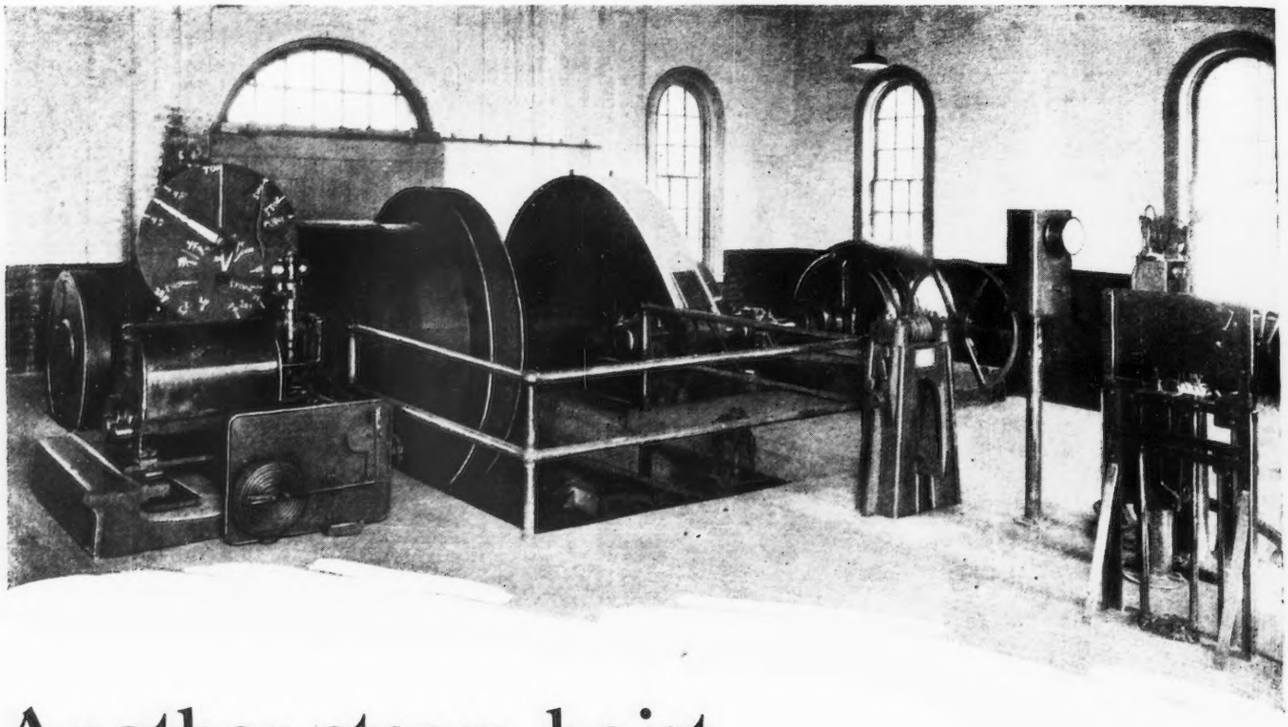
**INGERSOLL-RAND COMPANY - 11 Broadway - New York City**

***Offices in principal cities the world over***

**For Canada Refer—Canadian Ingersoll-Rand Co., Limited, 260 St. James Street, Montreal, Quebec**

41-RDM

# Ingersoll-Rand



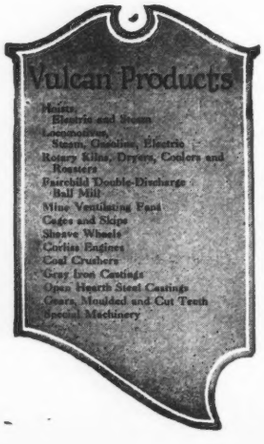
# Another steam hoist electrified!

This mine hoist, which was originally driven by 24 in. x 36 in. steam engine, is now driven by a 500 hp. motor, 585 R.P.M.

The drum is 6 by 4 feet and winds 4800 feet of 1-inch rope at a speed of 1200 feet per minute. The motor was connected through herringbone gears. The old steam brake was converted so as to be operated by air; and complete Vulcan Safety Devices were added. The old engine bearings have been used; as may be noted in photo where the old bed plates were cut off.

The hoist now handles 25 car trips, each care weighing 6300 lbs. over and average grade of 5.6%. The total haul is 4800 feet. The hoist makes 30 trips every 7 hours; or 750 cars.

If your hoist is now steam driven, the cost of a changeover will be very little compared to the cost of an entirely new hoist. For particulars write Vulcan Hoist Engineers. It will more than pay you.




VULCAN IRON WORKS
WILKES-BARRE, PA.

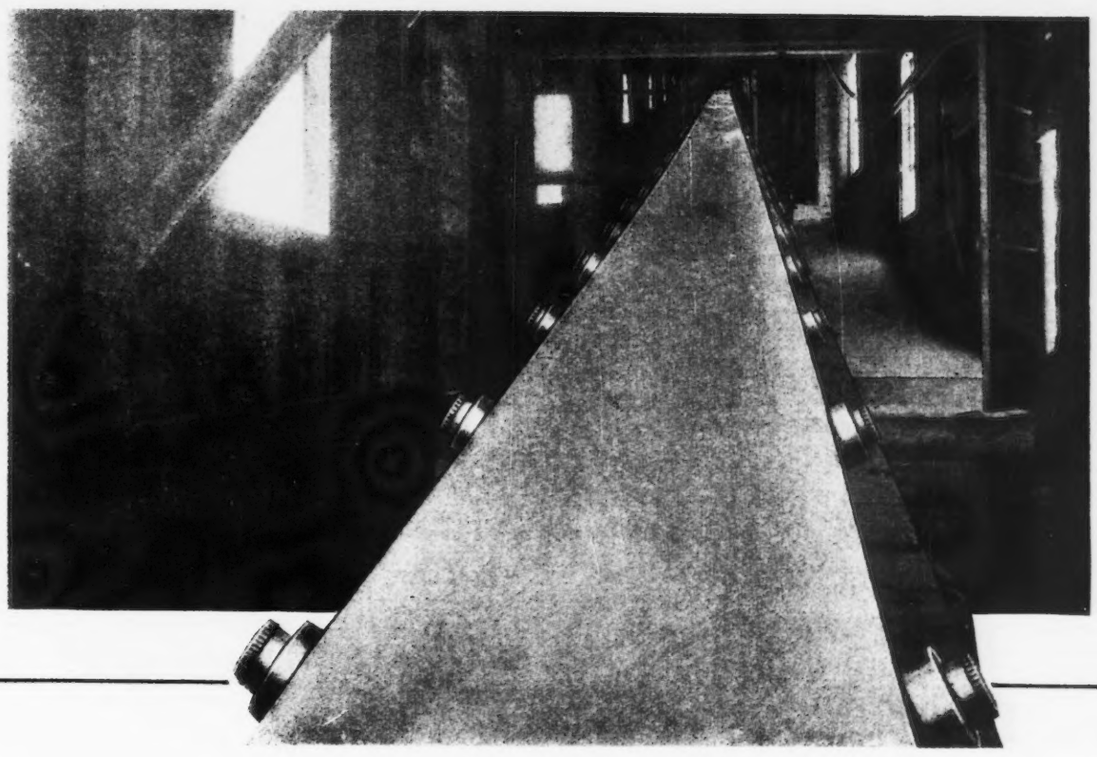
New York Office: 50 Church St.

*Established 1849*

Chicago Office: McCormick Bldg.

VULCAN *of* WILKES-BARRE HOISTS

# WEBSTER



## Belt longevity— a WEBSTER characteristic

The design and construction of Webster belt carriers is always to secure very uniform contour for the loaded belt, ease of carrier revolution, operation with the maximum of power, and to insure long service from belts.

The use of carefully housed ball bearings makes an equipment that is as nearly frictionless as it is possible to get. Webster Carriers will run for long periods without any attention.

A further feature of Webster conveyor carriers is the special design which tends to keep the belt lined up and always kept central.

Webster Belt Conveyors are ruggedly constructed, and in a number of types for varied service. Webster installations are many of the longest and most important in the country.

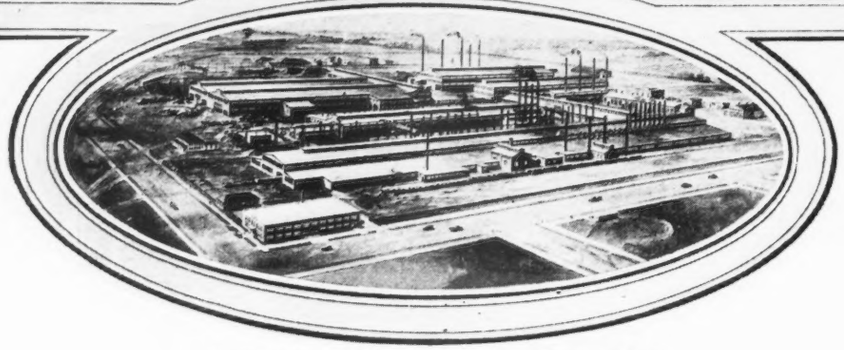
*We make a complete line of material handling equipment.*

THE WEBSTER MFG. COMPANY

1856 N. Kostner Ave., CHICAGO

Branch Offices in All Principal Cities

*Main Plant of United Division, Canton, Ohio*



*South Plant of United Division, Canton, Ohio*

# Now

# Two Sources of Supply

## Agathon Alloy Steels

**In Daily Production**

Nickel, Chrome-Nickel
UMA, Molybdenum
Chrome-Molybdenum
Nickel-Molybdenum
Vanadium, Chrome-Vanadium, Chromium, etc.
Deliveries in Blooms, Billets, Slabs, Hot Rolled, Heat Treated, and Cold Drawn Bars.

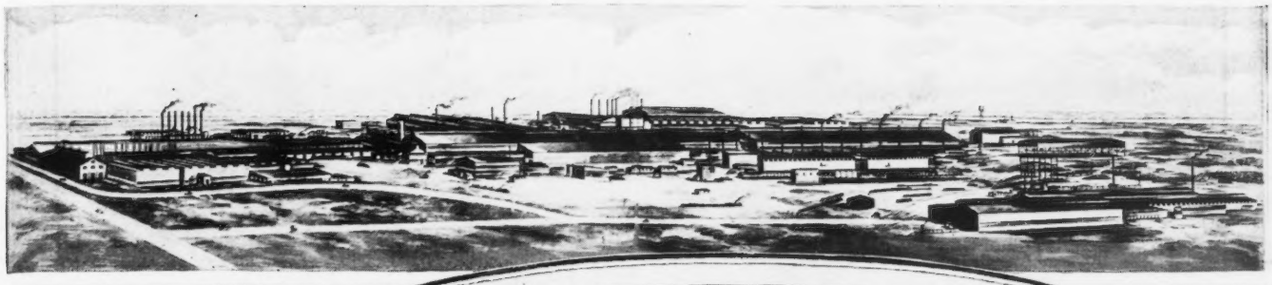
THE CENTRAL ALLOY STEEL CORPORATION combines two distinct and completely self-contained steel plants with facilities so complete as to constitute virtually two sources of supply.

No other organization is so thoroughly equipped with metallurgical ability for scientific research and for the actual supervision of high quality production.

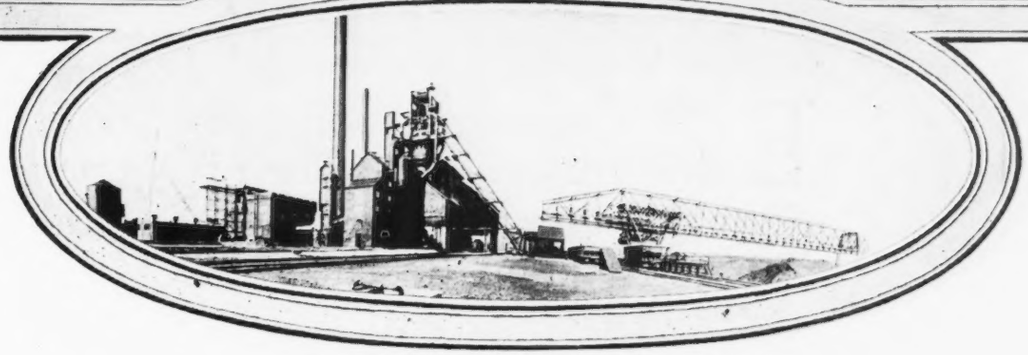
The Central Division, at Massillon, Ohio, has a blast furnace of 800 tons daily capacity, which will be served by a 49-oven by-product coke plant. Melting and rolling capacity for a yearly production of 400,000 tons of alloy steel blooms, billets, bars, etc., 100,000 tons of hot-rolled strip for automobile frames, brake drums and all heavy stampings, and 70,000 tons of special finish sheets, make this one of the most important units in the special steel industry.

AGATHON STEELS

AGATHON



*Main Plant of Central Division, Massillon, Ohio*



*Blast Furnace, Central Division, Massillon, Ohio*

# from Ore to Finished Steel

The United Division, at Canton, Ohio, has a blast furnace of 650 tons daily capacity served by a 47-oven by-product coke plant. The capacity for alloy, carbon and special steel blooms, billets, bars, etc., is 520,000 tons per year. Electric furnace equipment provides 50,000 tons of electric steels annually, while the capacity in both common and special finish sheets, black, galvanized, terne-coated, etc., is 280,000 tons per year.

The combined facilities of this great organization make possible to a greater degree than ever before a highly efficient and well-rounded service to the user of alloy steels and sheets.

## Other Agathon Products

High Finish Sheets
Blue Annealed Sheets
Black Sheets
Galvanized Sheets
Terne-coated Sheets
Hot Rolled Strips
Toncan Metal
Enduro Stainless

**Central Alloy Steel Corporation, Massillon, Ohio**

CLEVELAND DETROIT CHICAGO NEW YORK
SYRACUSE PHILADELPHIA LOS ANGELES TULSA

# ALLOY STEEL

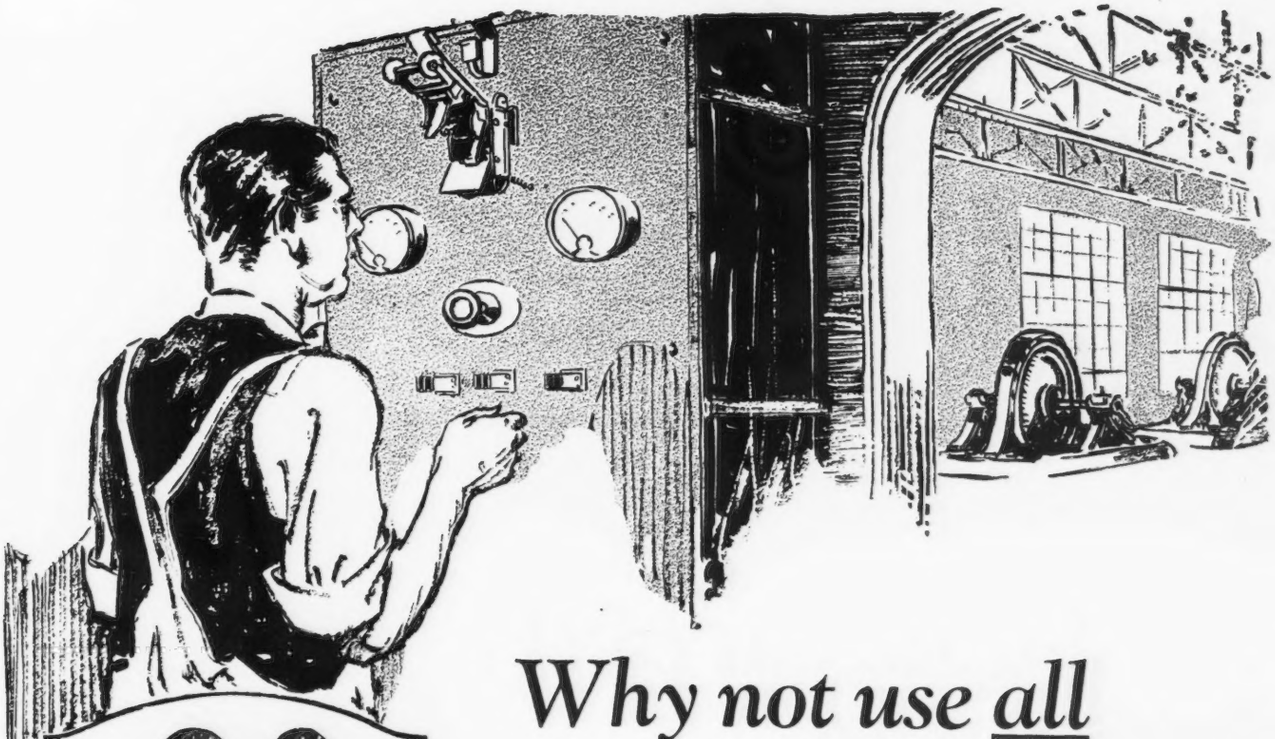
# *You* BENEFIT

EVERY person in industry and trade who answers a McGraw-Hill questionnaire directly contributes to the welfare of the particular business with which he is identified.

McGraw-Hill makes it a rigid policy not to send you a questionnaire unless the information which you possess can be made of vital interest to American business.

The success of McGraw-Hill Publications in obtaining basic information is due to general recognition of the fact that a McGraw-Hill questionnaire is accepted in this spirit everywhere in industry and trade.

THE PUBLISHERS



# *Why not use all your power?*

BOOST your power factor. Cut down power waste. Use Cutler-Hammer Magnetic Clutches with power-factor-boosting synchronous motors. Lower power costs will surely follow.

Comparatively heavy starting loads no longer bar synchronous motors. C-H Magnetic Clutches allow synchronous speed to be reached before the load is applied.

C-H Magnetic Clutches multiply the applications of synchronous motors—make them practical where you may now think only induction motors will serve.

Use C-H Magnetic Clutches with synchronous motors on pulverizers, pumps, fans and rotary dumps. Your power factor will jump. Power costs will drop.

***Automatic control easy with C-H Magnetic Clutches***

**For modern methods of control, Cutler-Hammer Magnetic Clutches have marked advantages over other types.**

**Any device for making and breaking a circuit will engage and disengage C-H Magnetic Clutches. Possibilities for automatic control are endless.**

**For instance, a float switch starts the sump water pump when a predetermined high level is reached—stops it at a predetermined "low." With a pressure regulator switch, efficient pressure value is maintained automatically in the air compressor accumulator. With a centrifugal governor switch, the clutch on any drive can be automatically engaged and disengaged at predetermined speeds giving sure protection for equipment.**

***Bulletin No. P-11 tells all about C-H Magnetic Clutches—many other ways you can profit by using them. Write for a copy.***

**The CUTLER-HAMMER Mfg. Co.**
*Pioneer Manufacturers of Electric Control Apparatus*
1236 St. Paul Avenue
MILWAUKEE, WIS.

# CUTLER C-H HAMMER

***Industrial Efficiency Depends on Electrical Control***

# Square dealing built Linde's reputation

IN THE emergencies of the last fifteen years —and there have been emergencies of many kinds—the spirit of a business house has had many opportunities to show itself.

Were the customers' rights protected? Or were excuses delivered instead of materials, and customers left to look out for themselves?

Linde's reputation with its customers during all these years is one of which the company is justly proud. The rights of the customer have always been paramount.

As a Linde customer you are sure of your oxygen supply, not only in times of plenty, but in times of emergency as well. It is guaranteed by 37 Linde plants, 105 Linde warehouses and by the Linde principle of giving the customer a square deal.

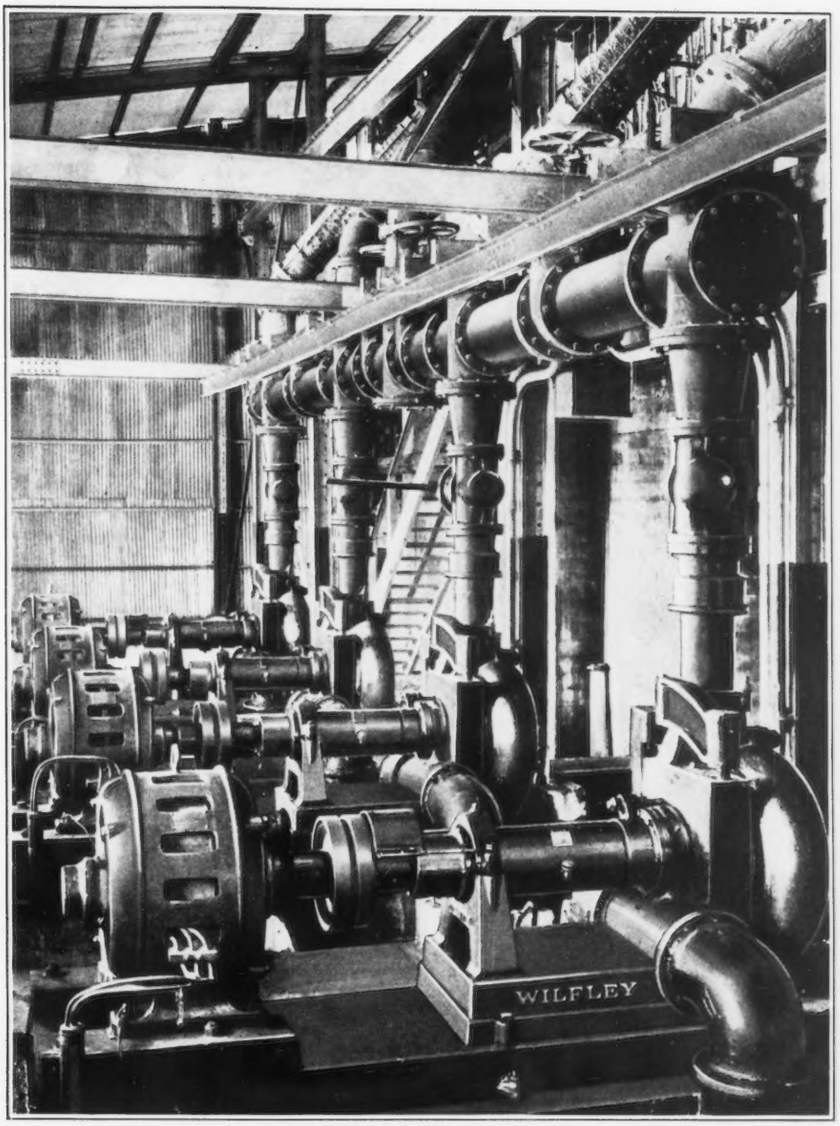
THE LINDE AIR PRODUCTS COMPANY

*Manufacturers of oxygen, nitrogen, pyrogen, argon and neon*
*Producers of helium for scientific purposes*

General Offices: Carbide and Carbon Building
30 East 42d Street, New York
37 Plants—105 Warehouses

OXWELDED PIPE FITTINGS are extremely successful and their flexibility recommends them to the average plant man. The Linde Procedure Control on oxwelded pipe fittings gives detailed instructions and is especially valuable on obscure points which enter vitally into the ultimate success of the operation.

CENTRIFUGAL
WILFLEY
PUMPS




# Will this Solve Your Sand Pumping Troubles?

A pump which has been successfully applied to pumping distances greater than a mile, densities up to 75% solids and for pressures up to 90 pounds per square inch.

A pump that eliminates the usual stuffing box and all its troubles.

A pump whose wearing parts are of remarkably long life, but which can be changed in a few minutes when necessary.

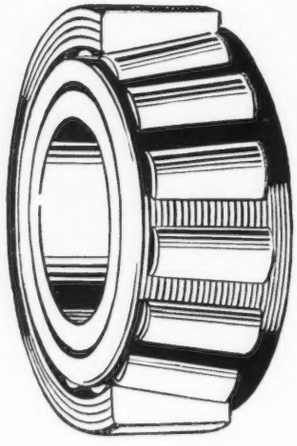
**These and other features are incorporated in the *Wilfley Centrifugal Sand Pump.***

## A. R. Wilfley & Sons
## Denver, Colo.~U.S.A.

# In his own interest

one of the most highly-reputed manufacturers of machine tools published the advertisement reproduced below. His statements are typical of the best thought today, among makers and users of Timken-equipped machinery of every type, for every purpose.

THE TIMKEN ROLLER BEARING CO., CANTON, OHIO



## Why we adopted Timkens

KEARNEY & TRECKER'S latest and largest milling machine — the New No. 4 — is equipped with Timken Roller Bearings.

This is not in answer to a popular appeal, nor to add another "talking point". Kearney & Trecker milling machines are not designed that way. Every improvement or new feature must stand the test of rigid experiment, otherwise it is never adopted.

In October 1921 we first put Timken Roller bearings into a milling machine. That pioneer machine has been running day in and day out in our own shop ever since. For five years it has been submitted to all manner of service far more severe than would ever be encountered in normal operation.

Exhaustive experiments have borne out the fact that anti-friction bearings provide (1) Greater load carrying capacity (2) Increased mechanical efficiency and (3) Longer life. Not only that, the reduction in overhanging loads and clearances required, all make for greater rigidity of drive.

Anti-friction bearings have earned their way into Kearney & Trecker milling machines by sheer merit. In our judgment, they accomplish the greatest usefulness in the bigger sizes of machines where it is necessary to transmit a large amount of power.

That is "why we adopted Timkens" in our new No. 4.

*MILWAUKEE MILLING MACHINES*

KEARNEY & TRECKER

MAIN OFFICE AND WORKS: MILWAUKEE, WISCONSIN